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EXPERIMENT STATION RECORD.

VOL. 38.

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No. 3

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

On the origin of the humin formed by the acid hydrolysis of proteins.—
III. Hydrolysis in the presence of aldehydes.—II. Hydrolysis in the presence of formaldehyde, R. A. GORTNER and G. E. HOLM (*Jour. Amer. Chem. Soc.*, 1917, No. 11, pp. 2477-2501, fig. 1).—Continuing the work previously noted (*E. S. R.*, 36, p. 108) the authors, at the Minnesota Experiment Station, have studied the reactions which take place when proteins are hydrolyzed in the presence of formaldehyde, with special reference to the formation of the black insoluble humin of protein hydrolysis and also, incidentally, to the composition of the "soluble humin" and "ammonia" fractions.

From the results it is concluded that "when proteins are hydrolyzed in the presence of trioxymethylene and the resulting hydrolyzate analyzed by Van Slyke's method, the nitrogen distribution is so altered as to bear no resemblance to the analysis conducted in the absence of aldehyde. When a protein containing tyrosin and tryptophan is hydrolyzed with increasing amounts of trioxymethylene, the figures for both insoluble and soluble humin nitrogen are rapidly increased to a maximum, after which there is a sharp decrease in the nitrogen content of these fractions. The ammonia fraction, on the other hand, decreases with the smaller additions of trioxymethylene and then rises rapidly for larger additions of aldehyde. When both tyrosin and tryptophan are absent from a protein, hydrolysis in the presence of trioxymethylene produces no change in the insoluble or soluble humin nitrogen and only a steady increase in the ammonia fractions. We have shown that the rise in the insoluble humin curve and the formation of black insoluble humin is due to the presence of tryptophan in the hydrolyzate, and we believe that the maximum point on the insoluble

nitrogen curve coincides closely with the amount of tryptophan nitrogen present in the hydrolyzate. An excess of trioxymethylene largely inhibits the formation of insoluble humin but does not break down insoluble humin which has been formed."

Histidin and cystin were found not to be involved in the formation of black insoluble humin as reported by Roxas (*E. S. R.*, 36, p. 412), and it is believed that tryptophan alone of all the hydrolytic products is involved in the reaction, as previously reported by the authors. The formation of the humin is indicated as being due to a combination of tryptophan with some unidentified aldehyde or ketone, and the only part which any of the other amino acids have in the humin formation is probably to furnish some of their nitrogen, either through adsorption or occlusion. "The α -amino group of the aliphatic side chain of tryptophan is not involved in the primary reaction by which black insoluble humin is formed. The primary reaction concerns only the indol

nucleus, inasmuch as the same reaction takes place when tryptophan is replaced by indol and it appears probable that it is the α -position of the indol nucleus which is reactive.

"The soluble humin nitrogen of proteins hydrolyzed in the presence of trioxymethylene is largely derived from tyrosin. However, the maximum point of the soluble humin curve includes some tryptophan nitrogen. We believe that it is possible to distinguish the soluble humin formed from tryptophan from that derived from tyrosin, for there is a sudden drop from the maximum insoluble humin nitrogen when additional aldehyde is added and then, on the further addition of aldehyde, the curve flattens and becomes approximately a straight line. The sudden drop we believe to be due to the nonformation of soluble humin from tryptophan due to the presence of an excess of aldehyde, and the straight line drop to the deamination of the tyrosin humin. If this is true an extension of the deamination curve until it intercepts the rising soluble humin curve should indicate the proportion of the soluble humin nitrogen due to tyrosin. The sudden initial drop in the ammonia fraction is probably due to the removal of some compound (tryptophan) in the insoluble humin when, when no aldehyde is present, contributes nitrogen to the 'ammonia' fraction. The sudden rise in the 'ammonia' curve with larger additions of trioxymethylene is not due to the formation of ammonia but to the deamination of amino acids and the formation of volatile alkaline compounds, the nature of which is still under investigation."

The identity of cyanuric acid with so-called "tetracarbonimid," E. H. WALTERS and L. E. WISE (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 11, pp. 2372-2377). Data are submitted which show that the so-called "tetracarbonimid" which has been prepared by oxidizing uric acid with hydrogen peroxid in alkaline solution is really cyanuric acid. The nitrogenous compound isolated from a number of soils and at first believed to be tetracarbonimid has been shown to be cyanuric acid.

The further isolation of cyanuric acid from a number of sandy soils from different localities in Florida, Norfolk sandy loam from Virginia, lawn soil from the grounds of the U. S. Department of Agriculture, Elkton silt loam from Maryland, Scottsburg silt loam from Indiana, Caribou loam from Maine, and a Susquehanna fine sandy loam from Texas is noted. From these results it appears that the acid or its precursor is widely distributed in soils.

See also a previous note (*E. S. R.*, 37, p. 612.)

The isolation from peat of certain nucleic acid derivatives, W. B. BOWEN (*Proc. Roy. Soc. [London], Ser. B*, 90 (1917), No. B 623, pp. 39-44).—From the results of the investigation the author concludes that "all the constituents of a true nucleic acid are present in raw peat, but nucleic acid as such has not been isolated. Nucleic acid must have been present in the plants from which peat has been formed, and since it is improbable that hydrolysis could have been brought about by the methods of extraction employed, the original nucleic acid has evidently been decomposed by bacterial or other agencies during the process of peat formation into the products which have been isolated." The probable course of the decomposition of the nucleic acid in peat is briefly discussed.

The work reported was only qualitative, but it is indicated that a quantitative study is in progress. The analytical procedures used are described in detail.

Fats from *Rhus laurina* and *R. diversiloba*, J. B. MCNAIR (*Bot. Gaz.*, 64 (1917), No. 4, pp. 330-336, fig. 1).—The following constants were obtained for the substances isolated from *R. diversiloba* and *R. laurina*, respectively: Sp

specific gravity at 18.5° C., 0.9872 and 0.8987; solubility, milligrams per liter in 95 per cent alcohol at 20°, 170 and 136; Hübl iodine absorption, 8.70 and 11.44 per cent; saponification value, 220.6 and 157.1; and melting point, 53 and 74°.

The substances are indicated as being more similar to Japan wax than to any other fat. A decrease in the poisonous properties of the fruit of *R. diversiloba* was found to occur simultaneously with an increase in its fat content. "The decrease in the poisonous properties in the ripening of the fruit of *R. diversiloba* eventually results in the fruit becoming nontoxic. This phenomenon is not necessarily due to a chemical transformation of the poison into fat, for (1) subsequent to the formation of fat the cells in which it is deposited become filled with starch; (2) it is possible for the plant to transform starch into fat; (3) fat is not formed in the parenchymatous sheaths of the resin passages; (4) subsequent upon the formation of fat, the resin passages are everywhere constricted by the growth of parenchyma sheaths; (5) a similar fat has been found in the fruit of a nonpoisonous species of *Rhus*."

A graphical chart showing the time when and the number of birds that eat poison-oak fruits is included.

The composition of loganberry juice and pulp, M. R. DAUGHTERS (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 11, p. 1043).—The following results were obtained in the examination of three samples of loganberry juice: Specific gravity (16° C.), 1.0523, 1.0477, 1.0508; percentage of acidity as citric, 2.306, 2.64, 2.169; percentage of acidity as sulphuric, 1.678, 2.159, 1.54; water, 88.96, 89.13, 90.548; total solids, 11.04, 10.87, 9.452; percentage of ash, 0.4130, 0.5785, 0.426; alkalinity (as K_2CO_3), 0.413, 0.5075, 0.288; protein ($N \times 6.25$), 0.3226, 0.431, 0.7375; sugar (as invert sugar), 6.56, 5.37, 8.39; alcoholic precipitate, 0.072, 0.4008; calorific value per liter, 290, 207, 385. The percentage composition of the moist and dried loganberry pulp, respectively, was found to be, moisture, 79.97; total solids, 20.03; protein ($N \times 6.25$), 3.727 and 12.81; ether extract, 3.790 and 13.089; nitrogen-free extract, 11.06 and 38.11; crude fiber, 8.59 and 28.89; ash, 0.695 and 2.394; acid (as citric), 1.367 and 4.706; calories (per pound), 426 and 1,458.

The oil obtained yielded the following constants: Specific gravity (15.5°), 0.926; refractive index (15.5°), 1.4811; solidifying temperature, -33°; iodine number, 158.32; saponification number, 179.8. The oil is indicated as lying between hempseed oil and tung oil as a drying oil.

Summary of the composition of wines of current consumption, G. FILLAUER (*Ann. Falsif.*, 10 (1917), No. 105-106, pp. 321-405).—These pages contain data for the various wines of the harvest of 1916 (E. S. R., 37, p. 12).

A new form of safety pipette, A. S. BEHRMAN (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 11, p. 1047, figs. 2).—A device which consists of an ordinary pipette or a Mohr pipette, used in conjunction with a three-way stopcock, and a stiff atomizer bulb properly valved is described.

A convenient automatic device for rapidly washing pipettes, A. V. FULLER (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 11, pp. 1046, 1047, fig. 1).—The construction and operation of a convenient apparatus are described by a diagram.

An asbestos stopper, J. B. NICHOLS (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 11, p. 1047).—The author describes the preparation of an asbestos stopper which was used in a distillation which involved the use of fuming sulphuric acid at a temperature of about 350° C. A plaster of Paris mold was made of a rubber cork, and then tamped with a mixture of asbestos-magnesia mixture (used for steam packing) and long-fibered asbestos. After proper drying the stopper was found to be just plastic enough to be firmly pressed into the

neck of the flask, and although it became hard during the distillation could be removed without difficulty. By moistening again it could be used for a second distillation.

An accurate method for taking aliquots of a standard in standardizing solutions, C. F. MILLER (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 11, p. 2385).—The following method is proposed:

About five times as much of the standard as is desired for the titration is carefully weighed and dissolved in a quantity of water slightly exceeding five times the capacity of the pipette to be used in taking the aliquots. Five portions of the solution are then carefully drawn in an identical manner, and the remainder, together with the rinsings from the pipette, is transferred to a tared platinum dish, evaporated, dried, and weighed. The pipette need not be standardized nor its exact capacity known. A simple calculation gives the amount of material in each aliquot.

The method can be used only for such substances as sodium carbonate, sodium oxalate, etc., which are soluble and separate from the solution again in a weighable form upon evaporation.

The nomon—a calculating device for chemists, H. G. DEMING (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 10, pp. 2137-2144, figs. 2).—The author describes the use of a calculating chart which he has devised and which has a degree of precision about five or ten times that of an ordinary 10-in. slide rule. Special scales can be easily constructed to adapt the chart for varied calculations.

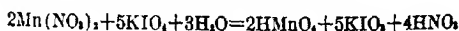
Observations on the McLean-Van Slyke iodometric method for the titration of small amounts of halids, in its application to chlorids, R. F. McCRACKEN and MARY D. WALSH (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 11, pp. 2501-2506).—The authors have found that when a titration is made very slowly in the McLean-Van Slyke method a starch-iodid color that might be mistaken for the end point sometimes develops before the titration is complete. This color gradually disappears as the end point is approached, even when several times as intense as the end point color. By supplementing the starch present in the titration with 10 cc. of a 1 per cent soluble starch solution just before titration, the end point is obtained in a clear solution instead of an opalescent solution.

Both the original method and the method with the use of additional starch, as noted above, are indicated as giving satisfactory results.

Determination of chlorin in blood serum and albuminous body fluids. M. LAUDAT (*Jour. Pharm. et Chim.*, 7. ser., 16 (1917), No. 6, pp. 168-171).—In the titration of chlorin after oxidation with nitric acid the development of the yellow color during the action of the nitric acid on the protein was found to interfere with obtaining a sharp end point and consequently caused slightly low results. The use of potassium permanganate was found to eliminate this source of error and the following procedure was developed:

To 5 cc. of the serum or other sample 10 cc. of tenth-normal silver nitrate, 6 cc. of a saturated solution of potassium permanganate, and 10 cc. nitric acid (specific gravity 1.38) are added and the mixture carefully heated for several minutes. After cooling, the liquid is made up to 100 cc. volume and the excess silver nitrate titrated with tenth-normal potassium sulphocyanate, using ferric alum as indicator. It is noted that the procedure requires but five or six minutes for completion, and yields accurate results as shown by comparative data.

The colorimetric determination of manganese by oxidation with periodate. H. H. WILLARD and L. H. GREATHOUSE (*Jour. Amer. Chem. Soc.*, 39 (1917), No. 11, pp. 2366-2377).—A method based on the equation



¹ *Jour. Amer. Chem. Soc.*, 37 (1915), No. 5, pp. 1128-1134.

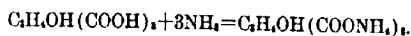
has been devised and is described. The general procedure is to bring the material to be analyzed into a solution containing in 100 cc. at least from 10 to 15 cc. concentrated sulphuric acid, 20 cc. of nitric acid or from 5 to 10 cc. of stumpy phosphoric acid, or mixtures of two or more of the acids. The solution must be previously freed from reducing agents by boiling with nitric acid, adding a little persulphate if carbon compounds are present. If chlorides are present the solution should be evaporated with nitric and sulphuric acids. From 0.2 to 0.4 gm. of potassium or sodium periodate is added, the solution boiled for a minute, kept hot from five to ten minutes, cooled, diluted to the proper volume, and compared with a standard of known manganese content, similarly prepared. The solution, when ready to be compared, should not contain much more than 1 mg. of manganese per 50 cc., as otherwise the color would be too dark. In the presence of considerable iron either sulphuric or phosphoric acid must be present, since the ferric periodate is insoluble in concentrated nitric acid but readily soluble in other acids.

The method is indicated as being specially adapted for the determination of manganese in water, soil, ores, and other materials in which it is present in small amounts.

An attempt to use the reaction as a basis of a volumetric method was unsuccessful.

A bibliography of 34 references to the literature on the colorimetric determination of manganese is appended.

Some suggestions concerning the preparation of ammonium citrate solution and the determination of insoluble phosphoric acid, P. MCG. SHUEY *Chem. Indus. and Engin. Chem.*, 9 (1917), No. 11, p. 1045).—The author notes that he has found that the neutral point in the preparation of ammonium citrate by the addition of ammonium hydroxide to citric acid can be reached at once by calculating the amount of ammonia required for a given amount of citric acid according to the following equation:



Practical examples of the preparation of ammonium citrate solution and some notes on its use for determining soluble phosphoric acid in various materials are included.

The determination of soil phosphorus, C. O. ROST (*Soil Sci.*, 4 (1917), No. 4, pp. 295-311).—In the study reported the author, at the Minnesota Experiment Station, compared the fusion with sodium carbonate method, the Fischer and Hildard (*E. S. R.*, 15, p. 746) methods, involving extraction with strong acid, the Washington hydrofluoric acid method, a modification of Washington's method proposed by Robinson (*E. S. R.*, 34, p. 806), and a modification proposed by himself for the determination of phosphorus in soils. The author's modification of Washington's method provides for the elimination of the organic matter of soils and the complete extraction of the phosphorus by means of hydrofluoric and nitric acids. The procedure is described in detail.

The results of the comparative study show that only a negligible quantity of phosphoric acid was recoverable from the separated silica with the fusion method. Neither evaporation with magnesium nitrate previous to ignition nor precipitation of the phosphoric acid with the sesquioxides of iron and aluminum in order to separate it from the excess of sodium salts was found advantageous.

The Fischer method recovered practically all of the phosphoric acid in the test soils, but in most cases with mineral soils a considerable amount was left in the insoluble residue. None was lost by volatilization or rendered unrecoverable by the formation of compounds of iron and aluminum insoluble in

nitric acid. That left in the residue was the result of an incomplete extraction by the acids employed." In one soil the Hilgard method extracted as much acid-soluble phosphoric acid as did the Fischer method, but in another sample considerably less.

"Washington's method, when applied to soils and modified to the extent of igniting the residue to dull redness after the final evaporation with nitric acid, failed to recover the whole of the phosphoric acid present. The residues upon being fused with sodium carbonate yielded the missing amount, thus showing that the low percentages found by this method are not due to volatilization during ignition but to incompleteness of extraction by nitric acid.

"Robinson's modification of Washington's method extracted only from 50 to 65 per cent of the total phosphoric acid, the remainder being found partly in the residue and partly in the filtrate from the yellow precipitate. With soils high in organic matter the magnesium pyrophosphate obtained by this modification of the method carried a considerable amount of magnesium oxid, which was derived from precipitated organic compounds. A temperature so low that no glowing was produced failed to oxidize the organic matter completely. Samples analyzed by this modification of Washington's method, with the exception that after the first evaporation with nitric acid they were ignited to very dull redness, behaved similarly, although no phosphoric acid was found in the filtrate from the yellow precipitate." The incomplete extraction of the phosphorus from soils by Washington's method was found to be due to over heating of the residue, causing the formation of difficultly soluble phosphates or iron and aluminum.

The amount of titanium oxid found in soils is considered to be too low to interfere with the precipitation of the phosphorus.

The data are submitted in tabular form and discussed.

Rapid determination of bran contained in flour and bread, R. LEGENDRE (*Ann. Falsif.*, 10 (1917), No. 105-106, pp. 293-296, fig. 1).—The following procedure is described:

After determining the moisture in a 2-gm. sample of flour or a 3-gm. sample of bread crumbs, the material is treated in a test tube or other suitable container with 10 cc. of water and 10 cc. phosphoric acid (specific gravity 1.38) and the mixture heated in an autoclave for one hour at 120° C. After cooling, the contents of the tube are placed on a small, previously moistened silk sieve (number 100 or 120) and carefully washed with a small stream of water until the washings are clear. The bran on the sieve is returned to the tube, water added, and the mixture again returned to the sieve and washed. After being thoroughly washed it is collected, dried, and weighed. Where the method is used for spaghetti and similar products the time of heating should be prolonged.

The procedure is indicated as being sufficiently accurate for the detection of adulteration of either flour or bread.

Tentative standard methods for the sampling and analysis of commercial fats and oils, other than those of the coconut, butter, and linseed groups (*Jour. Indus. and Engin. Chem.*, 9 (1917), No. 11, pp. 1066-1070, fig. 1).—The methods of sampling and analysis reported have been adopted by the committee on the analysis of commercial fats and oils of the Division of Industrial Chemists and Chemical Engineers of the American Chemical Society as tentative standards for the use of the trade pending their official adoption by the society.

Occurrence of manganese in insect flowers and insect flower stems, C. C. McDONNELL and R. C. ROARK (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 3, pp. 77-82).—Tabular data relative to the manganese content of stems

of "open" and "closed" flowers of *Chrysanthemum cinerariaefolium* of both Dalmatian and Japanese origin are submitted.

The manganese content of both stems and flowers was found to vary so much and the difference in amount to be so small in these two parts of the plant as to render valueless any method for estimating the amount of powdered stems from an insect powder from its manganese content.

The Japanese pyrethrum contained more manganese than that from other countries. This is indicated as being probably due to the high manganese content of the volcanic soils of Japan. An increase in the manganese content of pyrethrum was found to be accompanied by a slightly higher nitrogen and phosphoric acid content.

On potato utilization possibilities, H. C. GORE (*Proc. Potato Assoc. Amer.*, 3 (1916), pp. 70-75).—This is a brief discussion of the manufacture of potato starch and dextrin and of potato drying, together with a method developed by the author for drying potatoes, practicable in small factories or on farms.

A preliminary report upon the making of potato silage for cattle food, by A. ROUX and H. C. GORE (*Proc. Potato Assoc. Amer.*, 3 (1916), pp. 75-79).—The authors have found that the use of from 2 to 5 per cent of corn meal mixed with crushed potatoes insures an acid fermentation which converts potatoes into a good silage. The process can be carried out on either a large or small scale and with reasonable care the losses are negligible.

The potatoes should be first well washed and then properly crushed. The container in which the fermentation takes place must be tight and so covered to exclude as much air as possible.

The resulting product is indicated as being very desirable and to be eaten only by cattle. Although eaten less readily by hogs at first, they soon learn to eat it.

The market for sunflowers (*Rhodesia Agr. Jour.*, 14 (1917), No. 4, pp. 508-510). This is a brief report from the Imperial Institute of the United Kingdom, the Colonies, and India on utilization of and markets for sunflowers from Rhodesia.

It is noted that practically the only industrial purpose to which plant pith is applied at present is in the manufacture of pith helmets, and that for this purpose the sunflower pith appears to be less suitable than the others commonly used. This point, however, is being investigated further. The pith can not be employed as a substitute for wood and cotton in the preparation of cellulose on account of its low yield and physical condition. Its possible use as material for packing in the sheathing of ships and for stuffing life-saving appliances for use at sea is being investigated.

The material is considered unsuitable for use in feeding stuffs on account of its indigestibility and high absorptive capacity for fluids. Since no experimental work appears to have been done in this connection, it is indicated that feeding trials should be carried out. Its admixture with molasses is indicated as probably a suitable way of feeding the material.

After the removal of the pith from the stems a good yield of pulp is obtained which, however, is only suitable for the manufacture of common brown paper, since it can not be satisfactorily bleached. The best method of using the stems is indicated as being either to chop them for use as manure, since they contain nearly 5 per cent of potash, or to burn them and use the ash, which contains nearly 50 per cent of its weight of potash. The ash might also be employed for the extraction of crude potash as is now done in Russia.

Evaporated apples, C. S. MCGILLIVRAY (*Canada Dept. Agr., Health Anim. Branch Bul.* 24 (1917), pp. 38, figs. 33).—This is a report on the evaporated apple industry in Canada. The general topics treated are different types and

equipment for evaporators, paring machines, bleachers, slicers, etc.; plans of evaporators; the curing room; and color, uniformity, cut, etc., of the finished product.

Canned foods, A. W. BITTINO (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Misc. Ser., No. 54* (1917), pp. 79, figs. 39).—This bulletin describes and discusses modern processes of commercial canning in the United States, the general system of grading, and products available for export.

Home and farm canning, W. V. CRESS (*California Sta. Circ. 158, rev. ed.* (1917), pp. 32, figs. 10).—In this revision (*E. S. R.*, 36, p. 509), special directions for meats and some notes on ptomaine and botulinus poisoning and on new methods of sterilizing fruits and vegetables have been added.

For vegetables low in acidity, the addition of lemon juice and sterilization at 212° F. was found to sterilize the material completely, but not in any way to be injurious to its flavor or texture. Since heating fruits at 212° always changes more or less the flavor, texture, and appearance, experiments were carried out to determine the lowest temperature at which complete sterilization was effected. Temperatures of from 165 to 175° were found to be sufficient and to yield most satisfactory products.

A German substitute for jute (*Agr. Jour. India, 12* (1917), No. 1, pp. 159, 160).—A material designated as "textilose" made from paper pulp which has passed through machines and been spun into thread or cord preparatory to weaving into a tough cloth is briefly noted. The material is reported as possessing remarkable wearing qualities and to be a creditable substitute for the natural fiber, though higher priced.

METEOROLOGY.

Relation between temperature and crops, D. A. SEELEY (*Abs. in U. S. Mo. Weather Rev., 45* (1917), No. 7, pp. 354-359, figs. 3).—Previous attempts to determine the relation between weather and crop production are reviewed, especially with reference to the methods employed.

Observations at East Lansing, Mich., during 1915 and 1916 on the temperature of the plant itself under varying atmospheric conditions are recorded. These show that the plant is much warmer than the air when bathed in sunshine, the excess in clear weather averaging about 15°, in partly cloudy weather, 10°, and in cloudy weather, less than 1° F. "Curves expressing plant growth rates and plant temperatures show parallelisms more decided than other temperatures observed, including maximum and mean air temperatures, soil temperatures, and readings of the 'black-bulb in vacuo.' A test of the number of heat units required to cause a cherry tree to blossom in the greenhouse and out of doors shows remarkably close results when plant temperatures are considered, but a consideration of air temperatures alone gives a wide variation.

"A formula is evolved for determining the effectiveness of air temperature in promoting crop development, as follows:

$$T=t+15C+10P,$$

t being the sum of maximum temperatures above 42° during a certain period, after that amount has been subtracted from each temperature, C being the number of clear, and P the number of partly cloudy days during the period."

A list of references to literature bearing on the subject is given.

Killing frost and length of growing season in various sections of Kentucky, F. J. WALZ (*Kentucky Sta. Circ. 19* (1917), pp. 121-132, figs. 4; *U. S. Mo. Weather Rev., 45* (1917), No. 7, pp. 348-353, figs. 4).—This paper summarizes and presents in tables and charts the results of a study of the dates of

the last killing frost in spring and the first killing frost in fall in Kentucky. The average dates of frost, the average number of days in the growing season, and the "standard deviations" from these averages are computed for each station and consequent risks or probabilities determined.

Predicting minimum temperatures, J. W. SMITH (*U. S. Mo. Weather Rev.*, 45 (1917), No. 8, pp. 402-407).—The importance of accurate methods of predicting mean temperatures in connection "with the development of orchard-heating methods and the protection of general fruit and garden crops from damage by frosts or low temperatures by heating, covering, or flooding" is pointed out. The methods used for this purpose are discussed.

A brief historical note by C. F. Marvin is appended.

Some field experiments on evaporation from snow surfaces, F. S. BAKER (*U. S. Mo. Weather Rev.*, 45 (1917), No. 7, pp. 365-366, figs. 2).—Observations at the Utah Forest Experiment Station in the Manti National Forest indicated an evaporation of about 3 in. during the winter of 1915-16 out of a snowfall equivalent to 21.91 in. of water.

Mean annual rainfall of the United States, R. DeC. WARD (*U. S. Mo. Weather Rev.*, 45 (1917), No. 7, pp. 338-345, pl. 1, fig. 1).—The purpose of this paper, which is based largely upon a new chart of average annual precipitation prepared by the Weather Bureau, is to present a clear, simple statement of essential facts regarding the rainfall of the United States from a broadly geographical rather than strictly meteorological point of view. The article discusses rainfall maps in general and the precipitation chart referred to in particular, and summarizes the essential features of rainfall in the eastern and Gulf provinces, the Great Plains, plateau provinces, and the Pacific coast. A list of special and general references to literature bearing on the subject is given.

Damage by hail in Kansas, S. D. FLOBA and C. L. BUSH (*U. S. Mo. Weather Rev.*, 45 (1917), No. 7, pp. 359-361, figs. 2).—A study of the extent and distribution of damage by hail, briefly reported in this article, indicates that the probability of damage from this cause increases toward the western portion of Kansas, although both the average rainfall and the rainfall for the crop-growing months in the western third of the State are less than half the averages for those periods in the eastern third. The causes of this increase in liability to damage by hailstorms in the drier, western part of Kansas remain to be determined.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 45 (1917), Nos. 7, pp. 375-385, pls. 9, figs. 18; 8, pp. 397-438, pls. 10, figs. 7).—In addition to weather forecasts, river and flood observations, and seismological reports for July and August, 1917; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during July and August, 1917; condensed climatological summaries; and the usual climatological tables and charts; these numbers contain the following articles:

No. 7.—Mean Annual Rainfall of the United States, with Notes on the New Chart of Average Annual Precipitation (illus.), by R. DeC. Ward (see above); Sea Breeze on Eastern Long Island (illus.), by E. S. Clowes; Influence of the Sea on the Climate of Long Island, N. Y., by E. S. Clowes; Killing Frost and Length of Growing Season in Various Sections of Kentucky (illus.), by F. J. Siz (see p. 208); Relation between Temperature and Crops (illus.), by A. Seely (abs.) (see p. 208); Damage by Hail in Kansas (illus.), by S. D. Floba and C. L. Bush (see above); Scarf Clouds (illus.), by C. F. Brooks; The Field Experiments on Evaporation from Snow Surfaces (illus.), by F. S.

Baker (see p. 209); Dark Day in Jamaica; and Distance at Which Thunder Can Be Heard, by C. E. Miller.

No. 8.—Aurora of August 21, 1917, by D. F. Manning; Aurora of August 22, 1917, at Washington, D. C., by I. F. Hand and C. Abbe, Jr.; Parhelia 90° from the Sun Seen in Jamaica (illus.), by M. Hall (reprinted); Magnetic Storm of August 26-27, 1916, by W. E. W. Jackson (reprinted abs.); Comparison of Gullendar Sunshine Recorder and Ångström Pyrheliometer, by J. Patterson (reprinted abs.); Penetrating Radiation in the Atmosphere, by G. C. Simpson (reprinted abs.); Meteorology and Aviation, by W. H. Dines (abs.); Prediction of Minimum Temperatures (with a historical note by C. F. Marvin), by J. W. Smith (see p. 209); The Lowest Air Temperature at a Meteorological Station, by B. Golitsyn (Golitsyn); Notes on the Hot Wave in Southern California, June 14-17, 1917 (illus.), by F. A. Carpenter; Changes in Weather Bureau Program of Meteorological Observations, by A. J. Henry (abs.); The Weather Bureau and the War, by E. B. Calvert (abs.); Normal Anomalies of Mean Annual Temperature Variations, by H. Arctowski (reprinted abs.) (E. S. R., 37, p. 417); Structure of Halbstones of Exceptional Form and Size, by E. J. Lloyd (reprinted abs.); Improved Methods in Hygrometry, by A. N. Shulz (reprinted abs.) (E. S. R., 37, p. 16); Factors Influencing the Condensation of Aqueous Vapor in the Atmosphere, by A. Masini (reprinted abs.) (E. S. R., 37, p. 716); Evaporation of Mercury Droplets Suspended in a Gas, by A. Schidlöf and A. Karpowicz (reprinted abs.); Evaporation and Absorption, by A. Schidlöf (reprinted abs.); Dynamics of Revolving Fluids, by Lord Rayleigh (reprinted abs.); and A Quintette of Cold Waves in Florida (illus.) by A. J. Mitchell.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and H. B. MILLARD (*Massachusetts Sta. Met. Rep.* 345-346 (1917), pp. 4 each).—Summaries of observations at Amherst, Mass., of pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1917, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Some notes on the direct determination of the hygroscopic coefficient, F. J. ALWAY, M. A. KLINE, and G. R. McDOLE (*U. S. Dept. Agr., Jour. Agr. Research* 11 (1917), No. 4, pp. 147-166).—This reports investigations conducted at the Nebraska Experiment Station from 1910 to 1913, on the development of a method for the direct determination of the hygroscopic coefficient in soils. Earlier studies (E. S. R., 20, p. 714) having led to such modifications of Howard's method (E. S. R., 15, p. 746) as would permit a large number of determinations being made rapidly without loss of accuracy. Observations were made upon the influence of the material of the trays, time of exposure, temperature, grinding, and various other factors. Tabulated data are presented and discussed for each point studied.

The conclusions reached were that "the amount of hygroscopic moisture absorbed increases with the rise of temperature. Drying of mineral soils at temperatures of 100 to 110° C. does not appreciably decrease their hygroscopicity. Intractable samples may be reduced in a steel mortar to pass a 1-mm. sieve without appreciably affecting their hygroscopicity. Twelve hours' exposure in the absorption boxes is sufficient only when the soil layer is very shallow. In practice a longer interval is found more convenient, 20 to 24 hours proving very satisfactory. An exposure of more than 24 hours gives higher values in the case of only very fine textured soils.

"A soil containing the amount of moisture corresponding to its hygroscopic coefficient loses water very rapidly when exposed to an ordinarily dry atmosphere, but in determining the hygroscopic coefficient the time necessary to transfer the soils from the absorption boxes to weighing bottles is so brief that the loss during the transfer is too small to affect appreciably the accuracy of the results.

"Hilgard's method for the determination of the hygroscopic coefficient, carried out exactly as he described it, gives reliable results. However, the loose sheets of glazed paper thus involved are very inconvenient when many determinations are to be made and may advantageously be replaced by shallow trays, either of aluminum or of copper. . . . Any considerable increase in the size of the absorption boxes over that recommended by Hilgard or the use of a larger number of exposed samples within the boxes of the same size cause too low results, unless the time of exposure be greatly increased."

A bibliography of 27 titles is appended.

Some factors affecting nitrate-nitrogen accumulation in soil, P. L. GAINES and L. F. METZLER (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 2, pp. 33-64).—The authors report the results of extensive investigations at the Kansas Experiment Station to ascertain the influence upon nitrate-nitrogen accumulation in soils of variations in some of the more important factors controlling aeration.

In preliminary experiments, variations in the quantity of soil amounting to from 50 to 1,000 gm. had little if any effect upon nitrification. Variations in the depth of columns of loose soil of from 0.25 to 20 in. did not produce appreciable differences in nitrification provided the soil was left loose, and nitrification was apparently no less vigorous 20 in. below the surface than at the surface. Packing the soil in a thin layer was without effect, but upon increasing the depth of column packing (reducing the volume from 14 to 9) resulted in a marked decrease in nitrate accumulation, the latter becoming negative only a few inches below the surface. A decrease in the ratio of surface exposed per 100 gm. of soil of from 314 sq. cm. to 2 sq. cm. had no effect upon nitrification. The shape and size of the container and methods of preventing evaporation and contamination were without effect except when the container was tightly stoppered and when the volume of inclosed air was relatively small in proportion to the soil volume.

These observations led to more detailed experiments of the effect upon nitrification of variations in depth of column and compactness of soil; of depth of column, moisture content, and compactness; of soil in sealed containers as compared with a soil surface exposed to the atmosphere; and of unbroken soil columns as compared with broken columns. The data are tabulated, discussed in some detail, and available experimental data reported by other investigators relative to the influence of different degrees of aeration upon nitrate formation briefly reviewed.

The authors conclude that "as the moisture content of a soil decreases, increasing the compactness from a very loose condition will increase the accumulation of nitrate nitrogen. With any degree of compactness tested the optimum moisture content will be reached when the soil contains approximately two-thirds the total amount of moisture it will retain. Aeration will be sufficient to the depth of 1 ft. with any degree of compactness, provided the moisture content does not exceed the above relation.

"Increasing the depth of column up to 2 ft. does not, as far as tested, alter the above relations. In fact, the accumulation of nitrate nitrogen increases with increasing depth down to 2 ft., so long as the moisture does not exceed approximately two-thirds saturation. Nitrate nitrogen accumulates more

rapidly in unbroken soil columns than in pulverized soil. Aeration in a column of soil uncultivated for seven years is far in excess of that required to maintain aerobic conditions.

"It has also been pointed out that such experimental data as are available regarding oxygen relations in normal field soils, indicate that obligate aerobic conditions almost universally exist within the first foot of surface. Therefore such beneficial effect as cultivating may have upon biological activity can not be attributed to increased aeration."

A comparative study of the nitrogen economy of certain Tennessee soils, C. A. MOORE (Tennessee Sta. Bul. 118 (1917), pp. 125-187, Figs. 7).—This reports the results of extensive pot experiments conducted during the 5-year period of 1909 to 1914, inclusive, with four distinct soil types designated as Cookeville, Crossville, Gallatin, and Jackson. The principal factors considered were: (1) the comparative utilization of nitrogen by crops on different soils with regard to the nitrogen naturally present and that supplied by sodium nitrate and farm manure; (2) the losses of soil and subsoil nitrogen under different conditions, including cropped and uncropped, limed and unlimed, and manured and unmanured soils; and (3) indications of nitrogen assimilation from the air independent of legumes. Each soil type was removed in layers as found in the field, transported to Knoxville and placed in 4-ft. cylinders sunk in the ground, each cylinder inclosing a surface area of approximately 1.67 sq. acre. The cylinders were fully exposed to the weather, but protected from birds by a screen cage. No artificial watering was given. Ten successive crops were planted in each of 60 cylinders, the remaining 31 cylinders being kept bare. Oats were grown the first season, followed by wheat four seasons. Millet followed each of the small-grain crops in the summer. The limestone and manurial treatments were moderate and well within the limits of farm practice. Considerable tabulated data are presented and discussed from both the crop and soil standpoint. The results are summarized as follows:

"The largest crops were produced by the Gallatin soil, which had decidedly the highest content of total nitrogen, but the yields decreased very rapidly in the course of the five years. The second largest yields were obtained from the Jackson soil, which had the lowest nitrogen content—only a little more than one-third of that of the Gallatin soil. The Jackson soil, however, maintained a more constant yield than any other, and in the last two years the crop equaled those from the Gallatin soil. The Cookeville and Crossville soils proved to be the least productive, and were practically on an equality in this respect. For the Cookeville and Crossville soils constancy of yield was obtained only on the limed cylinders. The results given by the 10 limed and cropped cylinders of each of the four types were used, therefore, in determining the percentage of nitrogen recovery from manurial applications and in certain other calculations.

"The recovery by crops of the nitrogen applied in the form of sodium nitrate varied with the kind of soil as follows: Cookeville 45.38, Crossville 53.71, Gallatin 87.08, and Jackson 72.21 per cent. The results are correlated with the productiveness of the soils; that is, the more productive the soil the greater the root development to intercept the nitrate—the greater the percentage of nitrate nitrogen recovered.

"The recovery by crops of nitrogen from the organic materials—manure and manure plus straw—varied with the kind of soil as follows: Cookeville 29.82, Crossville 34.52, Gallatin 37.58, and Jackson 23.88 per cent. The results are correlated with the physical nature of the soils; that is, the more open and porous soils show the highest recovery.

"The ratio between the nitrogen content and the dry matter of the crops varied little in the three soils—Cookeville, Crossville, and Gallatin—which averaged 63.11 gm. of dry substance per gram of nitrogen. The crops from the Jackson soil, however, gave a ratio of 120.01 gm. of dry substance per gram of nitrogen. A low nitrogen content was found to characterize alike the grain and the straw of the wheat, also the millet hay from the Jackson soil.

"In every instance the cropped soils maintained a decidedly higher nitrogen content than the uncropped. This difference was noticeable both in the surface soil and in the first 6 in. of the subsoil, but the results from the 12- to 24-in. depth were inconclusive. The losses of nitrogen from the surface soils under comparable conditions were as follows: Cropped, Cookeville 2.1, Crossville 1.2, Gallatin 12.4, and Jackson 0.4 per cent; and uncropped, Cookeville 6.8, Crossville 6.2, Gallatin 18.2, and Jackson 4.2 per cent. The average combined saving in surface soil and subsoil nitrogen for the three most representative types—Cookeville, Crossville, and Gallatin—was 8.4 mg. per gram of air-dry crop, or 93 mg. per gram of dry substance harvested.

"In uncropped experiments surface soil treated with ground limestone showed appreciable loss of nitrogen as compared with untreated. Under cropping, however, three of the four soils showed more nitrogen at the end of the 5-year period in the limed cylinders than in the unlimed. This result is attributed to the offsetting of the direct loss through liming by the conservation of nitrogen brought about through increased crop production. The effect of applications of solid phosphate and muriate of potash on the content of soil nitrogen was not appreciable under cropping. No experiments were made under uncropped conditions.

"Where no crops were grown, top-dressings of nitrate of soda resulted in a small but evident loss of soil nitrogen. Under cropping the nitrated cylinders showed a greater supply of both soil and subsoil nitrogen than the unnitrated, the difference being slight for the soil but more pronounced for the subsoil. This result, as in the case of the ground limestone, is attributed to the more than balancing of the direct loss through nitrating by the conservation of nitrogen brought about through increased crop production.

"Manure applied to the surface soil of uncropped cylinders did not increase the nitrogen content of the subsoil. Under cropping the nitrogen content of the subsoils from the manured cylinders averaged somewhat higher than that from the unmanured; that is, manure applied to the surface soil conserved the supply of nitrogen in the subsoil.

"If the loss of nitrogen from both the soil and subsoil be considered, the loss from the Cookeville, Crossville, and Gallatin soils was in each case greater than can be accounted for in the crops removed. In the case of the Jackson soil, however, this was not so, the subsoil showing a moderate loss but the surface soil of the cropped cylinders a slight gain.

"The Jackson soil, which gave in many respects decidedly different results from any other, is noted as the only one to give evidence of the fixation of atmospheric nitrogen to a marked extent. To attribute this nitrogen accumulation to other exterior sources was considered untenable.

"The general conclusion is drawn that not only the cropping but also the material treatments conserved both the soil and the subsoil nitrogen to a total depth of about 1 ft., directly in proportion to the crop increase. This conservation does not, of course, prevent a loss of soil nitrogen through either chemical or biological processes induced per se by an applied substance such as ground limestone. In such a case the two opposing factors may or may not balance each other. Since cover crops are often advocated because they catch soluble nitrogen that would otherwise be lost by leaching, attention may be called to

the fact that the conservation referred to is not limited to the nitrogen utilized by the crops and conserved in the crop residues, but is an additional and actual conservation of soil nitrogen which may be utilized by farm crops."

The chemical composition of the soils of the Freehold area in New Jersey. A. W. BLAIR and H. C. McLEAN (*New Jersey Sta. Bul. 309 (1916), pp. 5-37*).—This reports chemical analyses of 31 soil types of seven series and of one sample of muck from the Freehold area of New Jersey, described and mapped by the Bureau of Soils of the U. S. Department of Agriculture (E. S. R., 34, p. 616).

The analyses show rather certain pronounced chemical differences between soils of the different series, but a measure of similarity between soils of a particular type, if that type is followed through the various series. Generally speaking, the soils containing the highest percentage of total plant food are the most productive. The total plant food increases from the lighter to the heavier types, with few exceptions. There is invariably more nitrogen and carbon in the soil than in the subsoil; in the case of nitrogen at least three times as much. There is little difference in the average mineral content of the soil and subsoil, although in many cases there is slightly more potash in the subsoil than in the soil. In most types magnesia is somewhat in excess of lime in both soil and subsoil. Practically all of the soils are deficient in active lime, the lime being mainly in the form of silicates or phosphates. In the majority of cases the lime requirement was from 1,000 to 3,000 lbs. of ground limestone or its equivalent in lime.

Soil survey of Washington County, Ala., L. A. HURST, E. H. STEVENS, H. C. SMITH, J. L. ANDRESS, and J. F. STROUD (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 51, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the State of Alabama, deals with the soils of an area of 6,180 acres in southwestern Alabama, lying wholly within the Gulf Coastal Plain province. The topography of the county varies from low, flat first-bottom lands and level terraces to undulating upland and eroded hills, the elevation ranging from sea level to 300 or 400 ft. above.

The soils of the county are derived from sediments from crystalline, limestone, and sandstone and shale areas of the Appalachian, Piedmont, and Limestone Valley regions, and occur both as sedimentary and as alluvial soils. Twenty-seven soil types of 18 series are mapped in addition to swamp and muck, Plummer fine sandy loam occupying 21.6 per cent, Norfolk fine sandy loam 14.4 per cent, and swamp 11.2 per cent of the total area, predominating.

Soil survey of the Honey Lake area, Cal., J. E. GUERNSEY, J. KOEBER, C. J. ZINN, and E. C. ECKMANN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 64, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 338,500 acres in the southeastern part of Lassen County, Cal., the topography of which is varied, ranging from level on the valley floor to rough mountainous in the foothills.

"The soils are classed under seven general groups (1) those derived from residual material, (2) those derived from old valley-filling material (chiefly Lahontan Lake beds), (3) those derived from material of the Lahontan beds modified by chemical precipitates, (4) those derived from recent lake deposits, (5) those derived from recent alluvial fan and stream-bottom deposits, (6) those derived from wind-laid deposits, and (7) miscellaneous material. In extent the old valley-filling soils are by far the most important, but are not extensively utilized. The recent lake-laid soils and recent alluvial soils support a large percentage of the present agriculture."

Including rough stony land, 35 soil types of 13 series are mapped, of which the Lahontan silty clay loam, Olympic stony loam, and rough stony land cover 14.8, 13, and 12.7 per cent of the area, respectively.

Soil survey of the Pasadena area, Cal., E. C. ECKMANN and C. J. ZINN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 56, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 270,720 acres in southern California, lying partly in San Bernardino County, but mainly in Los Angeles County. The topography of the area varies from mountainous to low and rolling, with elevations ranging from 225 ft. to 2,000 ft. above sea level. The region as a whole is well drained.

The soils of the area are derived from igneous and sedimentary formations and from unconsolidated deposits. Twenty-three soil types of nine series are mapped in addition to areas designated as rough broken land, rough stony land, and river-wash. Rough broken land occupies 16.3 per cent of the area, Hanford fine sandy loam 12.3 per cent, and Hanford gravelly sandy loam 10.4 per cent.

Soil survey of Crisp County, Ga., E. T. MAXON and D. D. LONG (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 24, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 173,440 acres in southwestern Georgia, including three physiographic divisions, namely, the Altamaha Uplands, the Dougherty Plain, and the "flatwoods." The topography varies from gently undulating to rolling, and drainage is well established with the exception of a few low, flat, poorly drained areas and lime sinks.

The soils of the county are of Coastal Plain origin and are predominantly sandy with sandy clay subsoils. Fourteen soil types of 11 series are mapped in addition to swamp. Norfolk sandy loam, Tifton sandy loam, and Plummer sandy loam occupy 31.7, 23.1, and 14.8 per cent of the area of the county, respectively.

Soil survey of Benton County, Ind., G. B. JONES and J. B. BRILL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 20, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology, deals with the soils of an area of 261,120 acres in northwestern Indiana. The topography of the county varies from level to gently rolling with the highest elevations in the north-central part. The natural drainage is described as immature, with overflow or bottom lands of small extent.

The soils of the county are derived from glacial drift and water-laid deposits of glacial and more recent origin and are characteristic of the prairie regions that extend westward through Illinois. In addition to muck, five soil types each representative of one series are mapped, Brookston silt loam and Carrington silt loam occupying 64.6 and 26.8 per cent of the total area of the county, respectively.

Soil survey of Scott County, Iowa, E. H. STEVENS, E. H. SMIES, and K. ESPE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 43, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station deals with the soils of an area of 291,200 acres in eastern Iowa, the topography of which is prevaillingly rolling, the central and western parts of the county being comparatively level. Surface drainage is said to be good throughout the county. The area lies wholly within the glacial and loessial province.

Including muck, 23 soil types of 13 series are mapped, of which the Muscatine silt loam, the Memphis silt loam, and the Wabash silt loam cover 52.1, 15.1, and 14.4 per cent of the area, respectively.

Soil survey of Dawes County, Nebr., R. R. BURN, L. V. DAVIS, J. M. SNYDER, F. A. HAYES, and T. E. KOKJER (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 41, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 897,280 acres in northwestern Nebraska, the topography of which varies from flat in the alluvial tablelands to very steeply rolling in the Pine Ridge areas. Drainage is said to be generally well established.

The soils of the county are of residual and alluvial or colluvial origin. Including rough broken land and bad lands, 22 soil types of 8 series are mapped, of which Pierre clay and Rosebud very fine sandy loam cover 20.1 and 19.5 per cent of the area, respectively.

Soil survey of Cortland County, N. Y., E. T. MAXON and G. L. FULLER (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 28, fig. 1, map 1*).—This survey, made in cooperation with the New York State College of Agriculture, deals with the soils of an area of 321,920 acres in central New York situated in the Allegheny Plateau with an elevation ranging from approximately 1,000 to 2,000 ft. above sea level. The topography varies from nearly level in the valleys to rolling and hilly in the uplands, with good drainage.

The soils of the county have been derived from glacial debris composed largely of local sandstone and shale material. Seventeen soil types of nine series are mapped in addition to meadow and muck. Lordstown silt loam, Lordstown stony silt loam, and Volusia silt loam occupy 31.7, 28.4, and 13.4 per cent of the area, respectively.

Soil survey of Columbus County, N. C., R. B. HARDISON, R. T. A. BURKE, L. L. BRINKLEY, and R. C. JURNERY (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 582,400 acres in the southern corner of North Carolina, lying in the flat seaward part of the Coastal Plain province. The topography of the county varies from large, flat, poorly drained areas in the southeast to gently rolling and better drained sections to the north.

The soils of the county are composed of marine sediments, together with extensive areas of cumulose deposits. Twenty-three soil types of 14 series have been mapped besides fairly large areas of peaty muck, muck, and swamp. Norfolk fine sandy loam and Coxville fine sandy loam occupy 32.2 and 11.9 per cent of the total area of the county, respectively.

Soil survey of Hertford County, N. C., E. S. VANATTA and F. N. McDOWELL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1916, pp. 35, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 220,800 acres in northeastern North Carolina. The county lies wholly within the Coastal Plain region, with a topography varying from level or gently undulating to gently rolling. The drainage is poor in the level to gently undulating areas and good in the more rolling areas.

The soils of the county are derived from unconsolidated sands and clays of sedimentary origin. Eight soil types of five series are mapped in addition to swamp. Norfolk fine sandy loam, Coxville very fine sandy loam, Coxville fine sandy loam, and swamp occupy 34.1, 25.5, 17.5, and 15.2 per cent of the total area of the county, respectively.

Soil survey of Portage County, Wis., W. J. GEIB, L. R. SCHOENMANN, and L. P. HANSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 52, fig. 1, map 1*).—This survey, made in cooperation with the State of Wisconsin, deals with the soils of an area of 519,680 acres in central Wisconsin, being a

more detailed study and reclassification than that previously noted (E. S. R., 16, p. 27; 19, p. 417).

The soils of the county are of glacial, residual, alluvial, or possibly loessial origin, together with an accumulation of organic matter in the low places resulting in the formation of peat, which occupies 16.4 per cent of the total area. Exclusive of the peat, 23 soil types of nine series have been mapped, of which Plainfield sand, Gloucester sand, and Gloucester sandy loam cover 13.1, 14.2, and 10.9 per cent of the area, respectively.

Soil survey of Wood County, Wis., W. J. GEIB, G. CONREY, W. C. BOARDMAN, and C. B. POST (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1915, pp. 51, fig. 1, map 1*).—This survey, made in cooperation with the State of Wisconsin, deals with the soils of an area of 517,760 acres in central Wisconsin, the topography of which is level to rolling. The soils of the area are of glacial, residual, alluvial, and possibly loessial origin.

Including muck, peat, and sands, 19 soil types of seven series are mapped, of which the Spencer silt loam, Vesper silt loam, and peat cover 25.9, 15, and 13.1 per cent of the area, respectively.

Soil experiments on the Ozark upland, M. F. MILLER and F. L. DULEY (*Missouri Sta. Bul. 148 (1917), pp. 28, figs. 7*).—This reports the results of experiments in soil management begun in 1910, near St. James, Mo., on Gerald silt loam in the nontimbered parts of the Ozark region and forms one of a series of such studies on various soil types throughout the State. The plan of the experiment embraces a four-year rotation of corn, soy beans, wheat, and clover grown alone and under different soil treatments, including the use of legumes, barnyard manure, lime, rock phosphate, bone meal, and potash. The average yields per acre of all crops for the period of the experiment were as follows:

Average yields per acre of all crops grown on St. James experiment field, 1911-1916.

Treatment.	Corn.	Corn stover.	Wheat.	Wheat straw.	Soy beans.	Cowpeas, 4 crops.	Clover, 2 crops.
	<i>Bu.</i>	<i>Lbs.</i>	<i>Bu.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Control.....	20.75	1,334	10.95	1,133	2,927	1,488	775
lime.....	24.98	1,607	12.08	1,281	3,196	1,669	1,687
lime, bone meal.....	26.56	1,674	18.56	1,963	3,273	2,017	4,912
treatment.....	20.84	1,481	8.75	894	2,592	1,387	657
lime, bone meal.....	26.25	2,286	21.85	2,344	3,392	2,065	5,425
lime.....	43.01	2,593	17.71	2,062	3,046	2,727	3,087
lime, rock phosphate.....	44.89	2,735	21.38	2,635	3,934	2,988	3,837

Tabulated data are presented and discussed, showing the results obtained with each crop separately, and the cost of production and the monetary returns from the different soil treatments.

Barnyard manure showed the highest net return for any one fertilizing material, amounting to \$7.07 per acre annually, or \$3.54 per ton for an 8-ton application once in four years. Eight tons of barnyard manure and 1,000 lbs. of rock phosphate, applied to clover stubble and plowed under, showed the highest annual net return for any combination of treatments, \$8.89 per acre. Bone meal netted \$2.43 annually, rock phosphate \$1.81, and potash \$1.88 per acre. Lime applied at the rate of 2 tons per acre at the beginning of a 6-year period was profitable, but the legume treatments alone have not been profitable.

Recommendations for soil management, based on the results obtained in the experiments, are outlined in detail. The main features are a system of bestock farming in which little grain is sold and all the manure carefully

returned to the land, the manure to be supplemented with ground limestone, raw rock phosphate, bone meal, acid phosphate, or a highly phosphatic mixed fertilizer, and a small amount of potash (when prices are normal) applied in the course of a systematic crop rotation.

[Fertilizer experiments], W. P. BROOKS and E. F. GASKILL (*Massachusetts Sta. Rpt. 1916*, pp. 45a-56a).—Progress reports are made on experiments previously noted (*E. S. R.*, 36, p. 121), including comparative tests of manure alone and nitrate of soda, sulphate of ammonia, and dried blood in various fertilizer combinations on Japanese millet; muriate v. sulphate of potash on corn, soy beans, alfalfa, blackberries, and raspberries; manure and various combinations of chemical fertilizers on beets and onions, limed and unlimed; different kinds of phosphates on corn; kainit, high-grade and low-grade sulphate, muriate, nitrate, and carbonate of potash, and feldspar on mixed grass and clover; fertilizer high in potash and low in phosphoric acid v. one low in potash and high in phosphoric acid on corn; various combinations of fertilizers, with and without lime, on corn; different systems of top-dressing grass; sulphate of ammonia v. nitrate of soda as a top-dressing for hay lands; and different methods of applying manure and different kinds of lime compounds on soy beans and corn.

The yield of onions on plats continuously fertilized with sulphate of ammonia was increased 60 per cent and more by liming. Similar results, but less pronounced, were obtained in case of beets. On plats continuously cropped with onions there was with one exception no benefit from the addition of chemicals to manure. The best source of nitrogen for onions was nitrate of soda and the least beneficial was sulphate of ammonia; there was little difference in effect between muriate and sulphate of potash. Considering the fact that no potash was applied in 1916 "It would seem that on land in a high state of cultivation, which has received liberal annual applications of fertilizers containing potash, a good crop [of onions] might be expected for at least one year without the use of any potash."

In 19 years' experiments with different sources of potash, high-grade sulphate has proved the best source of potash for legumes. No benefit has been derived from the use of feldspar in either large or small quantities. Kainit and muriate have given fully as good results as the other potash salts with timothy and redtop. Potatoes receiving no potash have proved less resistant to blight than those fertilized with potash.

The largest yields of corn in experiments continued since 1890 have been obtained where potash was added to the fertilizer used. The results of experiments on grass during the past year, in which potash was omitted from the fertilizer, "seem to indicate that on permanent mowings, where it has been the custom for several years to apply annually a liberal application of chemicals or manure, potash may be omitted for at least one year and still a normal crop be obtained."

The yields of hay on permanent grasslands which had been continuously top-dressed for 9 years with nitrate of soda and sulphate of ammonia were largest in 1916 in case of the nitrate of soda.

The results of five years' comparative tests of applying manure as it is hauled from the stable in winter and of piling it in large heaps and spreading in the spring were invariably in favor of the latter method of application, although the advantage was small.

In tests of different forms of lime compounds on corn and soy beans the results appeared to favor hydrated lime and limoid as compared with marl and ground limestone. The results obtained in these tests also indicated "that land which has received annually a liberal application of manure for several

ers will produce satisfactory crops for some time without further fertilization."

The lime and fertilizer needs of Indiana soils, S. D. CONNER (*Indiana Sta. Bul. 66 (1917), pp. 19, figs. 8*).—This circular, based on the results of various analyses of Indiana soils, identifies and classifies in a general way the principal types of soil of the State, and gives methods whereby the soils may be tested for their lime and fertilizer requirements by farmers, teachers, or agricultural agents.

It is shown that many of the soils have declined in productiveness as a result of exhaustive cropping. The soils have been depleted especially in organic matter and nitrogen but also in available phosphoric acid. Over three-fourths of them are acid, and on practically all of these available phosphoric acid is added, either with or without lime. "Potash fertilization has proved profitable on some soils. Neutral or slightly acid muck and black sand soils need potash, particularly for corn."

A soil-acidity map and other data are given, showing the relative proportion of very acid, medium acid, slightly acid, and neutral soils in each county of the State, as determined in over 4,000 samples of soil by the potassium nitrate method. These data show that no section is without an abundance of acid soils, the relative proportion for the entire State being 19.6 per cent very acid, 24.2 per cent medium acid, 38.2 per cent slightly acid, and 18 per cent neutral.

Practical methods of overcoming the soil deficiencies, such as the growing of leguminous crops, liming, use of acid phosphate and potash, and more careful conservation and use of manure and crop residues, are discussed.

Redeeming an impoverished soil, C. E. THORNE (*Mo. Bul. Ohio Sta., 2 (1917), No. 10, pp. 339-343*).—Increased yields of corn, soy beans, wheat, and clover, grown in rotation on the rather depleted flat, silty clay land of Clermont county (Ohio), were secured from applications of different combinations of commercial fertilizers, lime, and manure. The estimated value of the increase is set in each case for the period of 1912 to 1917. It is concluded that under present market conditions of fertilizers and crops, an increased net income of \$3 or more or more, annually, could be attained by the use of chemical fertilizers alone, but that under a system whereby manure could be applied at the actual cost of moving it from the stable to the field, necessitating the purchase of only acid phosphate, an increased net income of \$5 per acre or more would be possible.

Fertilizer requirement of DeKalb soil (*Pennsylvania Sta. Bul. 147 (1917), p. 26-22, fig. 1*).—Preliminary pot and small plat tests, begun in 1915, with various legumes and grasses on both abandoned farm land and virgin cut-over land to determine the fertilizer requirements of DeKalb soil are reported. In the small plat test limestone, applied at the rate of 5,000 lbs. per acre, was compared with an unlimed area. In the pot tests various fertilizers were tested in different combinations.

Limestone alone produced the following results, in pounds per acre, on the various soils on small plats. Green sweet clover, limed, 4,083 and 7,984, respectively, unlimed, nothing; green red clover, limed, 3,886 and 3,806, unlimed, 1,523 and 1,523. "Orchard grass gave better results than either brome or blue grass on the plats treated with limestone. In the pot tests the greatest growth of blue grass on the farm soil occurred in the pots treated with lime, nitrate of soda, and acid phosphate, while the lime, nitrate of soda, acid phosphate, and potash treatment produced the greatest yield on the virgin soil. Limestone and phosphate acid gave an increase of 125 per cent of sweet clover over limestone alone on the farm soil as compared to 580 per cent on the virgin soil."

The relative value of single fertilizer ingredients, for the farm and virgin soils, respectively, based on the growth of sweet clover, was, nitrogen 25.1 and 200, phosphoric acid 73.1 and 275, and potash 57.1 and 135.

"Based on the growth of sweet clover, phosphoric acid and limestone is conclusively the most economic treatment for building up these DeKalb soils. Phosphoric acid gave an increased growth in each case and its absence depressed the yield without exception. Nitrogen proved to be unnecessary for the production of red clover on DeKalb soil."

Thirty-five years' results with fertilizers (*Pennsylvania Sta. Bul. 147 (1917), pp. 17-20, fig. 1*).—The principal conclusions and recommendations from these experiments are summarized, the work having been noted in detail elsewhere (E. S. R., 37, p. 626).

Progress of green manuring in Mysore, A. K. YEGNANABAYANA IYER (*Mysore Agr. Calendar, 1917, pp. 14, 15*).—The green manuring of paddy lands and of sugar-cane plantations with leaves of the honge tree (*Pongamia glabra*) and with green-manure crops grown on the fields is briefly discussed. Crops used in the latter instance included sunn hemp, cowpeas, green gram, black gram, horsegram, *Crotalaria striata*, and daincha.

Previous studies in green manuring in Mysore have been noted (E. S. R., 27, p. 21).

[The relative value of oil cakes available in Mysore and the results of oil-cake manuring on sugar cane], H. V. KRISHNAYYA, A. K. YEGNANABAYANA IYER, and D. G. RAMACHANDRA RAO (*Mysore Agr. Calendar, 1917, pp. 18-23*).—The nitrogen content of the oil cake of safflower, peanut, white castor, black castor, neem (*Melia azadirachta*), honge (*Pongamia glabra*), and cotton seed is reported as determined by the Mysore Department of Agriculture. The analyses ranged from 3 to 8 per cent, with safflower cake showing the highest percentage. Greatly increased yields from the application of even small amounts of oil cake to sugar cane are briefly noted.

Cyanamid as a source of nitrogen (*Pennsylvania Sta. Bul. 147 (1917), pp. 23-25*).—Commercial cyanamid was compared with nitrate of soda and dried blood from 1912-1914, inclusive, for potatoes, oats, and wheat, and from 1913-1916 with nitrate of soda as a top-dressing for timothy.

The only significant differences were secured with potatoes, where increases over no nitrogen were obtained amounting to 32.8 bu. for nitrate of soda, 101.3 bu. for dried blood, and 56.7 bu. for cyanamid. With nitrogen as nitrate of soda used as a top-dressing for timothy, an average yield was obtained of 4,910 lbs. of field-cured hay per acre, and with cyanamid 4,618 lbs.

Availability of potash fertilizer residue in the soil (*Pennsylvania Sta. Bul. 147 (1917), pp. 38-40, fig. 1*).—A study of the availability of potash fertilizer residues in the soil is briefly noted, indicating that potash-treated land carries about twice as much potash removable by weak solvents as untreated land. Analyses of five crops, each grown in a different year upon treated and untreated land, show that the crops grown on treated soil removed 105.08 lbs. of potash in their grain and stalky parts, while those from the untreated plots removed 73.81 lbs. of potash to the acre yield. These results led to the following conclusions: "Clays and loams that have been well fertilized with potash until quite recently still hold in their surface layers considerable fertilizer potash in condition to feed the crops for several years. Hence for most field crops inability to supply fertilizer potash at this time does not threaten a great reduction in yields from lands of such history."

Relative value of limestone of different degrees of fineness (*Pennsylvania Sta. Bul. 147 (1917), pp. 22, 23, fig. 1*).—Experimental data are presented on the relative value of limestone of different degrees of fineness, based upon its

solubility in water, its value in correcting acidity, its value in the formation of nitrates, its influence upon the growth of plants, and the rate of loss from the soil.

"On the basis of the results obtained it was concluded, (1) that an application of limestone in which the entire product consists of very fine material is less desirable from the standpoint of permanent agriculture than one consisting of varied degrees of fineness; (2) that an ideal application of limestone is one in which there is sufficient fine material (60-mesh) to meet the immediate needs of the soil and thus allow time for the coarser particles to disintegrate; [and] (3) that if the entire product will pass a 10-mesh screen and include all of the fine material, it is sufficiently fine for soil improvement if applied somewhat in excess of the immediate needs of the soil. Such a product should contain at least 50 per cent of material that will pass a 60-mesh screen."

Effect of sulphur on different crops and soils, O. M. SHEDD (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 4, pp. 91-103).—Investigations are reported from the Kentucky Experiment Station on the effect of applications of 100 and 200 lbs. of flowers of sulphur on soy beans, clover, oats, alfalfa, and wheat, grown on eight rather depleted surface soils, each representative of a distinct soil type in Kentucky. The experiments were conducted in triplicate in the greenhouse. Tabulated data show the weight of the total air-dried materials for each crop on each soil type; the total and sulphate sulphur in air-dried soy beans, clover, and alfalfa; the percentage of sulphur as sulphate in 16 varieties of garden and field seeds before and after germination; and the protein content of air-dried soy beans, tops and seed.

In summarizing the author states that "the results show that the sulphur increased the production of some crops, had no effect on others, and on some was injurious, depending on the crop and the soil on which it was grown. There was a preponderance of gains, however, from the sulphur application, but these were generally small.

"Analyses of some of the crops show that the sulphur increased the total and sulphate-sulphur content of the plant, and the greater the application the greater the increase. Where sulphur was applied to clover and alfalfa the excess sulphur in those plants was in the form of sulphate, while in soy beans part of the excess was in another form.

"In soy beans which showed an increased sulphur content, no corresponding increased protein content was always found. In five instances out of eight, however, soy beans grown in soil where sulphur was added show an increase in the total weight of protein.

"It was found that of the 16 varieties of field and garden seeds examined some contain sulphates, while others do not, but that on germinating all except 2 form a greater or less amount of sulphate. The highest sulphate content obtained in the ungerminated seed was 0.048 per cent in clover, and the increase due to germination varied from none in corn to 0.035 per cent in the onion. There was a slight loss in only one sample—clover."

AGRICULTURAL BOTANY.

The effect of one plant on another, S. PICKERING (*Ann. Bot. [London]*, 31 (1917), No. 122, pp. 181-187, figs. 3).—Washings from growing plants have been shown to be deleterious to other plants reached by such washings. Susceptible plants thus far found include apple, pear, plum, cherry, forest trees (six kinds), mustard, tobacco, tomato, barley, clover, and two varieties of grasses. Plants exerting this injurious influence include apple (seedlings), mustard, tobacco,

tomato, 2 varieties of clover, and 16 varieties of grass. In no case have negative results been obtained, though the degree of injury varied greatly, this variation being ascribed mainly to the condition (vigor) of the plants employed. The reduction of growth due to this treatment varied from 6 to 97 per cent.

Tests employing the method of exclusion narrowed down the possible causation of injury to trees by grass to the possible formation of some deleterious substance by the growing grass, the effect being strongly suggestive of a toxia. Exposure of the leachings to the air for 24 hours removed the toxic property. A 2-in. layer of pumice stone acted in the same beneficial manner. The effect of a plant on its own kind is apparently greater than on a plant of another kind. A stronger plant not only keeps ahead of a weaker or younger one, but an older plant usually gains on a younger one continually.

Fungus fairy rings in eastern Colorado and their effect on vegetation. H. L. SHANTZ and R. L. PIEMEISEL. (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 5, pp. 191-246, pls. 21, figs. 15).—This paper deals with fairy rings caused by fleshy fungi, the studies on which were made on the high plains of Akron, Colo., during the period from 1907 to 1916, inclusive. The fairy rings are distinguished as those in which the vegetation is killed or badly damaged caused by *Agaricus tabularis*; those in which the vegetation is only stimulated caused usually by species of *Calvatia*, *Catastoma*, *Lycoperdon*, *Marasmius*, etc.; and those in which no effect can be noted on the native vegetation, caused by *Leptota* spp.

The authors report that fairy rings start from the point of germination of the fungus spores and spread outward at approximately an equal rate in all directions. Growth is continuous until some obstacle is met with, which may be passed around in case of ant hills, but growth is terminated where two rings come in contact. As the fungus filaments spread outward they are said to consume a portion of the organic matter of the soil. The carbohydrates are consumed, and the proteid portion is changed into amino acids and then into ammonia.

The effect of the fungus filaments on the soil is to reduce a part of the organic matter to ammonia, which is combined to form ammoniacal salts or is converted by bacteria into nitrites and later into nitrates. When the mycelium dies, it is reduced by bacterial action to ammonia, which may later be built up into nitrates. The increase in available nitrogenous material in the soil occupied by the young mycelium is said to stimulate the growth of the grasses or other young plants, which consequently make greater demands on the soil moisture. When this is exhausted, as in the case of *A. tabularis*, the mass of fungus filaments prevents the penetration of rain water. The intense drought to which the plants are thus subjected kills off the buffalo and grama grasses and the other plants which may be associated with them, and the area is left bare for the invasion of other plants. The mycelium after a few years dies, leaving the soil still more enriched and no longer impervious to water.

The stages in the succession on the bare areas are an early weed stage, followed by a late weed stage, and this in turn by a short-lived grass stage, which is succeeded by a perennial stage, and this finally gives way to the original short grass cover.

Growing alien cacti in Michigan. W. E. PRAEGER (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 156-158).—Thirteen species of cacti, representing four genera, from various altitudes in Arizona were tested in Michigan with the result that all died out in four winters. The general conclusion is that Arizona cacti can not survive Michigan winters, the warm, wet autumn weather probably being important in this connection. Cacti native to this region show a gradual loss of turgidity in the fall, which is thought to serve as the equivalent of a

deciduous habit and to be closely related to the ability of certain species of cacti to endure the Michigan winters.

Does the movement of air affect the growth of plants? ALMA HOLLINGES (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 159, 160).—In a preliminary report on investigations not yet completed, the author states that in darkness the movement of air apparently does affect favorably the rate, duration, and vigor of growth; also that it affects coloration, leaf spread, etc., in the several plants tested.

A method of controlling the rate of air movement in transpiration experiments. V. H. BLACKMAN and R. C. KNIGHT (*Ann. Bot. [London]*, 31 (1917), No. 122, pp. 217-220, fig. 1).—The authors, considering it advisable that transpiration and evaporation experiments with plants be carried on under conditions of constant air movements regulable at will, have devised an air-flue apparatus which is described as convenient, reliable, and satisfactory for air movement up to about 25 meters per minute.

The interrelations of stomatal aperture, leaf water content, and transpiration rate. R. C. KNIGHT (*Ann. Bot. [London]*, 31 (1917), No. 122, pp. 221-240, figs. 4).—Employing the air-flue apparatus above described in tests with various plants (of which *Eupatorium adenophorum* was found to be the most useful for this purpose) under controlled conditions, the author claims to have found that in many cases there is no necessary agreement (often, in fact, an inverse relation) between stomatal opening and transpiration rate. Water content of the leaf shows a close and direct relation to transpiration rate. Stomatal aperture is not reduced by slight water deficiency in the leaf, so that stomatal response to incipient drying may be excluded as a chief factor in the maintenance of water content. Stomata are, however, very sensitive to the changes in illumination, and with increasing light intensity continued opening of the stomata may coincide with continued decrease of water content.

On the reduction of transpiration observations, N. THOMAS and A. FERGUSON (*Ann. Bot. [London]*, 31 (1917), No. 122, pp. 241-255, fig. 1).—Experiments described are claimed to show that the evaporation from a circular water surface is not proportional to the area of the surface if that surface be within 2 or 3 cm. of the top, nor is it proportional to the linear dimensions of a surface. It is stated to be, for full circular containers, approximately proportional to the cube of the square root of the radius. Errors amounting to as much as 40 per cent are claimed to arise in determining the water surface equivalent to a given stomometer.

Methods of calibration are described which are claimed to obviate such errors.

Oxidation and reduction in vegetable tissues.—I, The mechanism of the reaction. J. WOLFF (*Ann. Inst. Pasteur*, 31 (1917), No. 2, pp. 92-95).—Three phases of the more mechanical part of this work are presented and briefly discussed in this article as preparatory to the report given below.

Oxidation and reduction in vegetable tissues.—II, The presence in a large number of plants of a diphenol presenting important analogies with pyrocatechin. J. WOLFF and NADIA ROUCHELMAN (*Ann. Inst. Pasteur*, 31 (1917), No. 2, pp. 96-105).—Discussing briefly the method employed and tabulating the results of observations made on a large number of plants, the authors conclude that peroxid is not present in vegetable sap, the presence of an oxidase (laccase) being necessary to the production of a positive result. It is thought that the reaction which has been believed to show the presence of nitrites and of peroxids in plants, and the eventually injurious effects of the latter, are due in the large majority of instances to the presence of a phenol, probably pyrocatechin. This is considered to play an important part in the processes of oxidation and reduction that occur in plants.

On the mechanism of translocation in plant tissues.—An hypothesis with special reference to sugar conduction in sieve tubes, S. MANOHAM (*Ann. Bot. [London]*, 31 (1917), No. 122, pp. 293-311, figs. 2).—This is a discussion of the data and views of various contributors regarding the processes which occur in a plant cell during certain phases of sugar translocation with a view to developing an outline of a working hypothesis.

It is stated that definite relations obtain between the solute concentration at the surface of absorbing particles introduced into the solution and the concentration of the solute in the solvent, this state of equilibrium being reversible in cases cited.

The influence of light and chlorophyll formation on the minimum toxic concentration of magnesium nitrate for the squash, R. B. HARVEY and R. H. TRUE (*Amer. Jour. Bot.*, 4 (1917), No. 7, pp. 407-410, figs. 2).—The minimal toxic concentration of magnesium nitrate for squash grown in water cultures was raised from $125 \text{ N} \times 10^{-6}$ in darkness to $200 \text{ N} \times 10^{-6}$ in light. This change was presumably correlated with the removal of magnesium from toxic compounds to form chlorophyll.

The toxicity of galactose and mannose for green plants and the antagonistic action of other sugars toward these, L. KNUDSON (*Amer. Jour. Bot.*, 4 (1917), No. 7, pp. 430-437, figs. 4).—Having extended the studies previously reported (*E. S. R.*, 35, p. 28; 36, p. 125) to include numerous experiments with various sugars other than galactose, employing methods which are described, the author shows that mannose also is toxic to the roots of some plants, and that this toxicity is lessened by either glucose or saccharose. Mutual antagonism was not found to exist between galactose and mannose.

Dr. Beal's seed vitality experiments, H. T. DARLINGTON (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 164-166).—Giving some account of the progress of the series of experiments conducted by Beal since 1879 (*E. S. R.*, 17, p. 463; 24, p. 135; 34, p. 732), the author reports the results of his endeavors to obtain germination from seed samples taken out the thirty-fifth year.

Of the 22 species originally employed, 8 are said to have failed to germinate up to and after the fifth year, the remaining species germinating some years, and *Lepidium virginicum* (probably also *Rumex crispus*) germinating every year. The best results were formerly obtained by moistening the sand so as to get a few seeds to come up, then allowing the sand to dry out partly, moistening again, and so on, repeating this at varying intervals for several months. This plan has been adopted by the author and the tests are reported as still in progress.

The nongermination of seeds of fleshy fruits, J. MASSART (*Bull. Sci. France et Belg.*, 50 (1916), No. 3, pp. 167-169; *abs. in Rev. Sci. [Paris]*, 55 (1917), No. 10, p. 309).—Tests of seeds of a number of dry or fleshy fruits in vegetable juices, saccharose of different concentrations, and water are said to indicate that the delaying influence of these juices on the germination of fleshy fruits and their destructive action on dry fruits show a variation parallel to that of their osmotic pressure, from which it appears that concentration is the condition essential to such influences. Seeds of different plants are unequally sensitive to these juices. The juice of the blackberry and that of watermelon appear to be particularly injurious.

Some factors concerned in the germination of rust spores, E. B. MAISE (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 136-140).—This work, initiated because of the difficulty of obtaining germination during the summer months and done mainly during the summer of 1914, was carried out principally with uredospores, though a few teleutospores and aecidiospores were tested. Details are given of the tests and the results thereof in case of *Puccinia coronata* (*P. coronifera* et

P. rhamni), *P. tarazaci*, *P. sorghi*, *P. phlei-pratensis*, *P. polygonti*, *Uromyces trifolii*, *Colcosporium solidaginis*, *Metamora biplomii*, *M. medusa*, *Cronartium complonia* (aecidial stage, *Peridermium complonia*), and *C. comandra*. *

The general factors controlling spore germination appear to be temperature and moisture. Other factors are discussed in connection with the work of other investigators.

Light and pycnidia formation in the Sphaeropsidales, E. LEVIN (*Rpt. Mich. Acad. Sci.*, 17 (1915), pp. 134, 135).—In experiments for testing the effect of light in connection with the germination of seven members of the Sphaeropsidales, only three germinated at all in the darkness, the percentage being about 30 to 40, while in the light representatives of all of the genera germinated, giving percentages ranging from 30 to 100. The cultures obtained in the darkness resembled in all respects those obtained in the light.

Some cultural characteristics of *Pestalozzia funera*, P. V. SINGERS (*Rpt. Mich. Acad. Sci.*, 17 (1915), p. 141, pl. 1).—Brief accounts are given of the results as regards the vegetative growth obtained in 14 days with *P. funera* grown on gelatin and upon several kinds of agar.

The colorimetric determination of hydrogen ion concentration and its applications in bacteriology, W. M. CLARK and H. A. LUBS (*Jour. Bact.*, 2 (1917), No. 1, pp. 1-34, figs. 4; 2, pp. 103-136, pl. 1, figs. 2; 3, pp. 191-236, fig. 1).—The authors have made a study of the colorimetric method of determining hydrogen ion concentration, testing a number of indicators in a wide variety of solutions, such as are used for the cultivation of bacteria, and have carried out other related studies as described. They conclude that, with the improvements presented, the colorimetric method is available for routine as well as for research work in bacteriology.

A new apparatus for aseptic ultrafiltration, R. E. SMITH (*Phytopathology*, 7 (1917), No. 4, pp. 290-293, figs. 2).—A description is given of an apparatus designed for the production of aseptically filtered juice from unheated plant extract that may be used as a culture medium.

Irritability of the pollen-presentation mechanism in the Compositae, J. SMALL (*Ann. Bot. [London]*, 31 (1917), No. 122, pp. 261-268).—A record is made of the types and degrees of irritability observed in the pollen-presentation mechanism of 149 species and varieties of Compositae. Of these, 64 per cent exhibit this phenomenon, and it was observed in all tribes of this family except the Eupatorieae and the Vernonieae. Notes are given also on certain special cases observed, as, for example, the explosive irritability in the Mutisieae and a peculiar slow movement in the Cichorieae.

Endothia pigments, I. L. A. HAWKINS and N. E. STEVENS (*Amer. Jour. Bot.*, 4 (1917), No. 6, pp. 336-353, figs. 6).—From the experimental work here described it appears that there are at least three different pigments formed by species of *Endothia*, pigment A, apparently common to all the species; pigment B, present in *E. fluens* and probably in all species showing a similar lateral transmission of the acid alcohol solutions; and pigment C, present in the two groups typified by *E. fluens* and *E. parasitica*. These pigments may be closely related chemically, perhaps derivatives of the same substance, as they are similar in many particulars. The data and opinions of other investigators are considered in connection with detailed observations by the authors.

Observations on an *Achlya* lacking sexual reproduction, W. H. WESTON (*Amer. Jour. Bot.*, 4 (1917), No. 6, pp. 354-367, pl. 1).—The fungus here described, though presenting characters distinctive of the genus *Achlya* as regards spore production, liberation, character, and behavior, is distinguished from most species of this genus by its lack of sexual reproduction and by its non-production of oogonia and antheridia under the culture methods usually suc-

cessful in developing these organs. This fungus, however, consistently produces, under widely varying conditions, resistant spores of nonsexual origin and distinct morphological characters, differing from the gemmæ described for other species in their regular occurrence and clearly defined structure. It is regarded as an Achlya that has lost its power of sexual reproduction, the resistant character usually assumed by the reproductive bodies of sexual origin having in this case been taken over by the nonsexual resistant spores.

Fertility in *Cichorium intybus*: The sporadic occurrence of self-fertile plants among the progeny of self-sterile plants, A. B. STOUT (*Amer. Jour. Bot.*, 4 (1917), No. 7, pp. 375-395, figs. 2).—The author, reporting with discussion further data obtained from a subsequent study of stock derived from cultures previously used (E. S. R., 36, p. 523), states that the evidence appears conclusive that the actual conditions giving the various grades of self-compatibility, and of self-incompatibility as well, are decidedly individual. The sporadic development of self-compatibility, giving self-fertility among the progeny of self-sterile lines, is frequent in the cultures herein reported. Cytological studies are planned with regard to the questions of relative development and nuclear phenomena in chicory.

In case of physiological incompatibility, as in these cases, there is thought to be no impotence except of a purely accidental sort. Any recombination may survive. The evidence does not indicate selective or preferential matings, favoring fusion between particular recombinations of germ plasma with respect to hereditary characters. The sporadic variability of the sex relations and their fluctuating inheritance is emphasized. A number of possibilities are suggested.

Inheritance of endosperm color in maize, O. E. WHITE (*Amer. Jour. Bot.*, 4 (1917), No. 7, pp. 396-406).—The author gives particulars of studies of crosses of a variety of maize having yellow endosperm with one having white endosperm, giving white only in F_1 and approximately 3 white to 1 yellow in F_2 , with further results. Some of these are interpreted as due mainly to the presence or absence of an endosperm color suppression factor. He claims that, including the one mentioned, there are at least three and possibly five pairs of factors concerned in the determination of endosperm color in maize.

Inheritance studies in Pisum.—IV, Interrelation of the genetic factors of Pisum, O. E. WHITE (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 4, pp. 167-190).—This paper describes and discusses the number of demonstrated factors in Pisum, their modifying effects upon each other's expression, the modification of their expression by different environments, and their relation to one another in inheritance, whether independent or linked.

Thirty-five genetic factors are listed and discussed. The presence and absence of these 35 factors are said to be responsible for 70 or more differential characters. The modifying effects of the expression of one factor upon another and the effects of external environmental conditions upon the expression of these factors are described. Data involving many thousand F_1 generation progeny indicate that certain factors are independently inherited, that is, they are not linked, unless the linkage is very loose. Data for four linked groups are presented, three of which involve some of the factors mentioned above and one the relations of which to the other seven are still undetermined.

FIELD CROPS.

Factors influencing the water requirements of plants, C. C. THOM and H. F. HOLTZ (*Washington Sta. Bul.* 146 (1917), pp. 3-64, figs. 18).—This reports extensive investigations of the various factors influencing the water require-

ments of plants embracing experiments with different field crops grown in galvanized-iron tanks from 1911 to 1913, inclusive, in field plats from 1912-1914, inclusive, and in sand cultures to which were added nutrient solutions of varying concentration. Considerable tabulated data are present showing the water requirements of crops under field conditions. The results are depicted by graphs. Additional data show the effect upon the water requirements of plants of the following factors: Kind of crop, percentage of ash in plants, concentration of the nutrient soil solution, fallowing, individual plant food elements, alkali salts, previous cropping, variety, stage of development, and percentage of capillary saturation. The conclusions reached have been summarized as follows:

"The numerous conditions surrounding plants that influence their growth and water requirement and the adaptability and habits of the plant to meet these conditions make it impossible to give any definite water requirement for any plant, or even to give the relative order in which a given number of varieties will stand in respect to this factor. The average water requirement [pounds of water required to produce a pound of dry matter] of 6 cereal crops was 312, and for 4 legumes, 429. The daily amount of water transpired by wheat, corn, oats, and peas increased until about the beginning of the ripening period; from this time there was a gradual decrease up to maturity. The depth to which field crops took moisture was: Wheat, 9 ft.; oats, 8.5 ft.; barley, 8 ft.; peas, 6 ft.; millet, 5.5 ft.; corn, 5 ft.; beans, 5 ft. The crops that took the soil moisture from the greatest depth also had the greatest water requirement. Tanks proved to be equal to field plats in determining the water requirements of plants. The ash content of different plants increased with the increased water requirement.

"Plants grown in culture solutions varying in concentration from 0.01 to 0.1 per cent increased in total dry matter produced and decreased in water requirement. The average of 3 trials, a 0.01 per cent concentration gave a growth of 3.152 gm. of dry matter and a water requirement of 729; in a 0.1 per cent concentration, 39.2226 gm. of dry matter and a water requirement of 351. The percentage of roots in the total dry weight decreased from 43.2 per cent in a 0.0125 per cent concentration to 17.3 per cent in 0.1 per cent concentration of a nutrient solution. In like manner the water requirement was reduced from 605 to 262, respectively. The above results indicate that weak soil solutions cause an increased root development in plants.

"The water requirement of wheat was 34 per cent less, and for beans 19 per cent less, when grown on summer-fallowed soil than when grown on cropped soil.

"When any of the essential plant food elements—nitrogen, potassium, phosphorus, and calcium—were reduced to 0.02 per cent and 0.01 per cent of that contained in a normal solution used in culture solution work in this bulletin, the reduction of calcium and potassium made good growths and nitrogen and phosphorus poor growths. The water requirement was increased in each case except when calcium was deficient. When nitrogen was reduced to 0.01 per cent of the normal solution, 43.2 per cent of the total dry matter produced was roots. When calcium was reduced to 0.01 per cent of the normal solution, only 10 per cent was roots. Consequently a soil with a low nitrate content causes a plant to develop an abnormally large root system. Increasing the concentration of a complete culture solution by addition of alkali salts, viz, sodium carbonate, sodium sulphate, and sodium chlorid, decreased the water requirement until the solution became so concentrated to inhibit growth.

"The water requirement of wheat was less when grown on soil that had grown legumes and intertilled crops the previous season than the soil that had grown cereals. The difference obtained in the water requirement due to

variety in spring wheat is small. There is a decrease in the water requirement of wheat and oats with increase in age.

"The percentage of capillary saturation of the soil in which plants are grown is not an important factor in the water requirement of plants, provided the percentage of moisture is maintained considerably above the wilting point. The results of these investigations indicate that any condition which disturbs the normal life processes, be it soil, atmospheric, or pathological, increases the water requirement to just such a degree as it depresses the normal functioning of the plant."

A bibliography of 27 titles is appended.

A new method for harvesting small grain and grass plats, A. G. McCall (*Jour. Amer. Soc. Agron.*, 9 (1917), No. 3, pp. 138-140, figs. 2).—A device for harvesting small grains and grasses in varietal and soil fertility tests is described and illustrated. The apparatus was constructed and used at the Maryland Experiment Station, where small areas of wheat and timothy plats were harvested, giving results which checked satisfactorily with records obtained from harvesting and thrashing entire plats.

[Report of field crops work in Nebraska] (*Nebraska Sta. Rpt. 1916*, pp. XV-XVII).—Water requirement investigations were continued through 1916, employing 425 potometers, and the relation of soil, climatic, and crop characters to the use of water by crops studied. Some of the more important conclusions arrived at are as follows:

"Transpiration is essentially evaporation. Changes in climatic conditions affect somewhat similarly the rate of water loss from a corn plant and that from a shallow physical free water surface. Variation in the water requirement from day to day is very marked. Occasionally this daily variation amounts to 300 or 400 per cent in successive days. The maximum variation observed in 2 successive days has been 600 per cent. On days of extreme temperature in very dry years there may be an atmospheric demand of 10 lbs. of water from a single average corn plant during 24 hours. . . . In a comparatively short time the corn may receive injuries from which it never fully recovers. Bearing this in mind it is evident that a period of brief duration may affect yields more than the annual amount of rainfall.

"A marked variation exists in the water requirement of different years, due to natural climatic differences. There is a rather consistent relationship in the relative seasonal variations between (1) transpiration per unit of dry matter, (2) transpiration per unit of leaf area, and (3) evaporation from a free water surface. There is no such thing as a definite water requirement which is constant for any one kind of crop. A reduction in soil-moisture content below the optimum during three years reduced the water requirement per pound of ear corn 4.3 per cent and per pound of total dry matter 7.9 per cent. This reduction in water requirement was, however, accompanied by 37.3 per cent reduced stalk yield, 28.5 per cent reduced yield of ear corn, and 30.7 per cent lower yield of total dry matter. . . .

"An increase in the soil-moisture content above the optimum during three years increased the water requirement per pound of ear corn 13.5 per cent and per pound of total dry matter 8.2 per cent. This increase in water requirement was accompanied by 11.3 per cent reduced stalk yield, 21.1 per cent reduced yield of ear corn, and 16.7 per cent lower yield of total dry matter. . . .

"The water requirement per pound of dry matter is much larger in an infertile soil than in a fertile soil. Increasing the fertility of the soil reduces the water requirement for grain production and for total dry matter. An application of manure has a much greater effect upon an infertile than upon a

fertile soil. Thus, as an average for two years, equal applications of sheep manure to infertile, intermediate, and fertile soils reduced the water requirements for ear corn production 42.6, 25.4, and 10.5 per cent, respectively. For total dry matter these water requirements were reduced 23.9, 17.1, and 8.1 per cent, respectively. However, the total water requirement per plant was increased by an application of manure to infertile, intermediate, and fertile soil, respectively, 106.7, 42.6, and 23.7 per cent. . . .

"The water requirement for milo maize was the same as the average for 11 corn varieties, while it was considerably higher for Black Amber sorghum. It appears that the drought-resistant qualities of certain crops must lie elsewhere than in a markedly low water requirement per pound of dry matter."

In cereal investigations it was concluded that small seed when compared in equal numbers with large seed appeared at a disadvantage, but wheat planted in equal weights the yields were practically the same. When grown in competition plants from large seed appeared to have a slight advantage over those from small seed.

[Report of field crops work in Pennsylvania] (*Pennsylvania Sta. Bul.* 147 (1917), pp. 25-31, figs. 4).—Continuing work previously noted (*E. S. R.*, 33, p. 34), a comparison of plowing depths of 7.5 and 12 in., both in the fall and spring, for crops in rotation since the fall of 1909 has led to the conclusion that fall plowing gave slightly better yields of corn than spring plowing, while with all other crops the time of plowing made no significant difference in yield. Deep plowing gave no greater yields than shallow plowing.

In variety tests with wheat Dawson Golden Chaff has given the highest average yield, 33.4 bu. per acre, for the period of 1911 to 1916, with 11 others ranging from 30 to 30.7 bu. per acre.

The range in average yield of marketable tubers of 43 varieties of potatoes tested for the period of 1911 to 1916 was from 88 to 177 bu. per acre. The leading varieties were Silver King, Pan American, Whiton White Mammoth, Petoskey, Heath Late Beauty, Hamilton Early, Norcross, and Rural New Yorker No. 2, in the order named.

The leading oat varieties for 1911 to 1916 were Big Four, New Zealand, Fourth of July, Joannette, Kherson, New Danish White, and Czar of Russia.

In soy bean variety tests the leading varieties in order of yield for the four years of 1913-1916, inclusive, were as follows: In seed—Ebony, Chestnut, Mongol, Ito San, Ohio 10015, and Amherst; and in hay—Ohio 7496, Ohio 10015, Chestnut, Medium Green, Ohio 9035, and Amherst. The average yield of seed for the four-year period for the 20 varieties in the test amounted to 14.2 bu. and of hay, 4.462 lbs. In experiments to test the value of soy beans in place of oats in the rotation, it was concluded that the crops are of about equal value, except possibly in southern Pennsylvania, where soy beans yield better and where oats are less profitable. Soy beans planted with corn have resulted in slightly increased yields of dry matter and of protein.

The fertilizer treatments and yields from 1910 to 1916, inclusive, for a cropping system of corn, wheat, and clover on depleted land are outlined, but no definite conclusions drawn.

[Report of field crops work for 1915], J. B. HARRISON, C. K. BANCROFT, and R. WARD (*Rpt. Dept. Sci. and Agr. Brit. Guiana*, 1915, pp. 5-12, 13-15; *Jour. Bd. Agr. Brit. Guiana*, 10 (1917), No. 2, pp. 62-79).—A number of variety and hybrid tests with sugar cane and rice are reported, together with fertilizer tests with sugar cane.

Sulphate of ammonia resulted in a yield of 4.7 tons of cane per acre more than nitrate of soda. Applications equivalent to 450 lbs. of ammonium sulphate

showed a mean yield of 38 tons of cane for nine varieties as compared with 29½ tons without nitrogen.

Tests on 48 duplicate plats showed an increase of only 0.9 ton of cane per acre upon the addition of acid phosphate, both with and without an accompanying nitrogenous fertilizer. Another series of experiments showed an increase of 4 tons of cane per acre over the untreated plats from an application of 600 lbs. of basic slag. Tests to determine the effect of acid calcium phosphate upon the sugar content of the cane juice indicated that it was practically negligible, the expressed juice showing 1.794 lbs. of saccharose and 0.061 lb. of glucose with the phosphate; and 1.77 lbs. of saccharose and 0.058 lb. of glucose without it.

A number of observations are recorded of seedling canes from selfed and uncontrolled parentage. Of the selected canes from uncontrolled parentage 57.2 per cent proved upon analysis to be of high potential value, while 58.3 per cent of the selected hybrid canes possessed similar characteristics. However, only 64 canes of hybrid origin were deemed suitable for analysis, whereas 430 canes of uncontrolled parentage were selected.

[Report of field crops work], A. A. MEGGITT (*Ann. Rpt. Jorhat Agr. Expt. Sta.*, 1916, pp. 7-42; *Ann. Rpt. Agr. Expts. Assam*, 1916, pp. 7-25, 40-42).—Extensive variety and cultural tests with sugar cane are reported for 1915-16. Cultural tests indicated that a planting rate of about 8,000 sets per acre was the optimum for the region, and that decreasing the distance between rows within the limits of from 3 to 5 ft., with the sets 2 ft. apart in the row, increased the total acre yield.

Liming and fertilizer tests with pigeon peas, millet, gram, mustard, corn, and oats, and green manuring tests with cowpeas and pigeon peas are briefly noted. Tests with wood ashes as a supplement to cow manure and in place of lime have given excellent results in increased oat yields.

[Report of field crops work at Anakapalle Agricultural Station], G. R. HULSON and D. BALAKRISHNAMURTI (*Dept. Agr. Madras, Rpts. Anakapalli Agr. Sta.*, 1914-15, pp. 6; 1915-16, pp. 7; 1916-17, pp. 12).—Cultural, rotational, and variety tests with cotton, sugar cane, rice, and miscellaneous native crops are briefly noted, together with meteorological data for the period of 1914 to 1917, inclusive.

Grains for western North and South Dakota, F. R. BARCOCK, J. H. MARTIN, and R. W. SMITH (*U. S. Dept. Agr., Farmers' Bul.* 878 (1917), pp. 21, figs. 9).—Approved methods of grain production in western North and South Dakota and eastern Montana are outlined, and varieties of winter and spring wheat, oats, barley, rye, and flax deemed suitable for the region recommended.

Grains for the Utah dry lands, J. W. JONES and A. F. BRACKEN (*U. S. Dept. Agr., Farmers' Bul.* 883 (1917), pp. 21, figs. 8).—This outlines approved methods for the production of the small grain crops on the Utah dry lands and recommends varieties of winter and spring wheat, oats, barley, and winter durum deemed suited to the region. Corn, the grain sorghums, proso millet, and flax are said to be little grown.

The information presented is based largely upon the results of experimental work at the Nephel substation, previously noted (*E. S. R.*, 32 p. 525; 36, p. 528).

Leguminous crops in desert agriculture, A. and GABRIELLE L. C. HOWARD (*Agr. Jour. India*, 12 (1917), No. 1, pp. 27-43; *Fruit Expt. Sta. Quetta Bul.* 6 (1916), pp. 15).—The economic necessity of producing leguminous forage crops in the desert areas of India, to be used both for feed and for green manuring, is discussed. Tests with the drying and baling of shaftal (*Trifolium resupinatum*) and of alfalfa are noted, and the feeding value of the two crops compared, together with numerous reports on practical feeding tests in the Army.

A feeding analysis shows the nutritive ratio of alfalfa to be 1:3.2 and that of alfalfa 1:3.5.

Comparative value of legumes as green manures, M. O. JOHNSON, ALICE R. THOMPSON, and C. A. SAHR (*Hawaii Sta. Press Bul. 52 (1917), pp. 14, figs. 6*).—This is a popular discussion of the studies of leguminous crops for green manuring purposes in Hawaii previously noted (*E. S. R.*, 37, p. 320).

Soy beans and cowpeas, J. R. FAIN and P. O. VANATTE (*Ga. State Col. Agr. Circ. 46 (1917), pp. 8*).—A brief popular description of soy beans and cowpeas, together with cultural directions, recommendations as to varieties, and notes on the utilization of the crops.

Field production of yantias, gabis, and dasheens, G. O. OCFEMIA (*Philippine Agr. and Forester, 5 (1916), No. 7, pp. 223-234*).—This reports cultural tests with the crops named under conditions prevailing in the Philippine Islands. A brief review is given of cultural practices in the United States, Porto Rico, Hawaii, Barbados, New Caledonia, Haiti, and Malaysia.

[Variety tests with alfalfa], W. P. BROOKS and E. F. GASKILL (*Massachusetts Sta. Rpt. 1916, pp. 57a, 58a*).—Continued tests of alfalfa varieties have led to the conclusion that common alfalfa from northern-grown seed is equal to the higher-priced Grimm, both in yielding power and in resistance to winter-killing. Siberian alfalfa obtained from South Dakota winterkilled.

Barley, J. T. PRIDHAM (*Dept. Agr. N. S. Wales, Farmers' Bul. 112 (1916), pp. 3-22, figs. 7*).—The cultivation and handling of barley in New South Wales is discussed in a general manner, together with an economic discussion by I. R. Davidson, of the production of malting barley.

The production of clover seed under irrigation in southern Idaho, L. C. ADLER (*Idaho Sta. Bul. 100 (1917), pp. 19, figs. 9*).—Cultural methods and seed practices employed in the production of clover seed under irrigation in southern Idaho are discussed in detail. Clover seed is now produced from Washington County on the western border to Teton County on the east, with a range in elevation of from 2,200 to 5,500 ft. Practically all Idaho-grown clover seed is bought by eastern seed houses to blend with eastern- and foreign-grown seed because of its high color, purity, and vitality, factors said to be greatly influenced by the methods employed in its production. Yields of seed have varied from 4 to 8 bu. per acre for red clover, 6 to 7 bu. for alsike, and 6 to 10 bu. for white clover for 1914 to 1916, inclusive, and for different sections of the State. Cooperative action on the part of Idaho seed growers to encourage the sale of straight Idaho-grown seed in the United States is urged.

Increasing the yield of corn by crossing, D. F. JONES, H. K. HAYES, W. L. STONE, JR., and B. G. SOUTHWICK (*Connecticut State Sta. Rpt. 1916, pt. 5, pp. 225-247, pls. 2*).—Extensive investigations with 50 first-generation hybrids of the highest-yielding varieties of flint and dent corn in Connecticut are reported in a continuation of work previously noted (*E. S. R.*, 31, p. 331). The experiments were conducted cooperatively by the State and Storrs stations at Mt. Carmel and Storrs in 1914 and 1915 and at Mt. Carmel in 1916. The behavior of the first-generation crosses as compared with their parents is outlined and tabulated data presented showing the yields, the heights, and the number of days to tasseling and to maturity. The desirable crosses are noted and the general characters and special features of the hybrids discussed in detail.

The results, together with those obtained elsewhere, are deemed conclusive as to the value of crossing, without previous inbreeding, as a method for increasing the yield of corn. It is stated that of the 50 F₁ crosses, "88 per cent yielded more than the average, and of these 66 per cent yielded more than either parent. In time of ripening the first-generation crosses were on the average intermediate when compared with their parents. . . . This increase in

the rate of growth is considered to be fully as important under Connecticut conditions as any increase in yield.

"The highest yielding parents gave the highest yielding crosses, . . . but . . . there was apparently no relation between the yield of the parents and the increase in the yield of the cross. High average yielding parents gave as large increases, when stated in percentages, as low yielding parents. There was a tendency for the crosses whose parents differed in their ability to yield to give the greatest increase. This is also shown by the fact that the dent \times flint crosses gave greater increases in growth than the flint \times flint crosses.

"These facts bear out the assumption that hybrid vigor is not the result of an indefinite physiological stimulation, but merely the result of the bringing together of [the] greatest number of favorable growth factors. Crosses between varieties of diverse type therefore possess a greater total number of favorable growth factors than crosses between similar varieties, and hence give larger increases when crossed."

A statistical study of some indirect effects of certain selections in breeding Indian corn, H. L. RUTZ and L. H. SMITH (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 4, pp. 105-146, figs. 24).—In connection with breeding experiments with high- and low-protein and high- and low-oil strains of corn, conducted at the Illinois Experiment Station and previously noted (E. S. R., 20, p. 531), the authors report observations upon what they term "the indirect effects" of the selections by a statistical investigation of changes in certain physical characters of the ears of corn, including length, circumference, weight, and number of rows of kernels. The study involved the preparation of 470 distinct frequency distributions, and tabulated data are presented showing the frequency distributions with respect to the physical characters of the ears for the four strains in the crop of 1914, and showing the type and variability of the four strains with respect to each character studied for 11 crops, 1905-1915, inclusive. Similar observations are recorded for the two-ear strains, 1908-1916, inclusive, the erect- and declining-ear strains, 1907-1916, inclusive, and for the high- and low-ear strains, 1907-1916, inclusive, with considerable tabulated data and numerous graphs illustrating the means and standard deviations for each character studied in the different strains of corn. The results of the observations are summarized as follows:

"It is found that four distinct types of corn as regards length, circumference, weight of ears, and number of rows of kernels on ears are so well established that we may assign orders of values to the means of these characters that persist with but few exception in such changes of environment as have been experienced in 11 years of planting, from 1905 to 1915. While a few slight but significant progressive changes have been noted, the selections for chemical composition from 1905 to 1915 have not changed decidedly the differences in mean values of these characters. In fact, we are unable to assert with any high degree of probability that the strains differ more or less with respect to these characters during the second half of the period 1905 to 1915 than during the first half.

"The standard deviations of the strains do not differ nearly so much compared to their probable errors as do the means, and it is not in general nearly so easy to discriminate among strains by the differences of standard deviations as by the use of means. There is one marked exception to this, in that we easily distinguish high-protein and high-oil from low-protein and low-oil strains by the differences in the standard deviations in weight of ears.

"No progressive change of consequence has taken place in standard deviations. The coefficients of variability, in comparison to their probable errors, differ

still less in a given season than the standard deviations, and there is no very general tendency for the coefficients of variability to maintain a definite order of values. That is to say, the differences of coefficients of variability of the four strains seem to be fairly well described, with certain exceptions noted in the paper, as random fluctuations.

The upper ears have a significantly larger mean value in length, weight, and circumference than have the lower ears on the same stalks. The means with respect to weight, length, and circumference of single ears are in each case larger than the corresponding means for the lower ears of the same plot. The means with respect to weight and circumference are also in general larger than these means for upper ears of the same plot. However, strange as it may appear, the mean lengths of single ears are on the whole less than those of upper ears. A striking fact in the comparison of the single ears with the upper and lower ears is the greater standard deviation in the weight of single ears.

Taken as a whole, there are no significant differences in [erect- and declining-ear] strains with respect to the characters considered. In view of the suggestion that ears are declining because of their greater weight, it is a fact of special interest that the declining ears are not on the whole heavier than the erect ears.

The ears of the low-ear strain are on the whole significantly larger in mean length, circumference, and weight than those of the high-ear strain, but there are a few exceptions. In each of the eight years considered the mean number of rows of kernels on ears is larger for the low-ear strain than for the high-ear strain. The standard deviation of number of rows of kernels in each year is distinctly greater for the low ears than for the high ears, and the standard deviation of circumference of ears is in general larger for the low-ear strain than for the high-ear strain."

[Nitrate experiments on "Nili" maize] (*Min. Agr. [Egypt] Circa. 22* (1912), pp. 4; 43 [1913], pp. 4; 48 [1914], pp. 7; 71 (1915), pp. 11; 81 (1916), pp. 9).—Experiments in the fertilizing of "Nili" maize with sodium nitrate and the so-called baladi and kufri manures are reported. These experiments have been conducted since 1911 and now embrace 50 demonstration farms in the three provinces of Gheezeh, Qaliubia, and Menoofeeyeh. The results obtained in each province are tabulated, and the general conclusions are as follows:

The use of nitrate of soda in maize cultivation apparently increased the yield 4.5 ardebs (25.2 bu.) after berseem and 3.5 ardebs after wheat above the yield secured from the use of kufri or baladi manures. Acid phosphate had no immediate effect on the crop. The use of 150 kg. of sodium nitrate per feddan (315 lbs. per acre) is recommended for Gheezeh Province when applied in two installments, one at the time of thinning and the second at the time of hoeing. The best results were obtained when from 75 to 100 loads of baladi manure was applied at the time of plowing and the nitrate added as indicated, but if baladi manure is not available, from 150 to 200 kg. of sodium nitrate are recommended.

Cotton variety tests for boll-weevil and wilt conditions in Georgia, A. C. Lewis and C. A. McLendon (*Ga. Bd. Ent. Bul. 46* (1917), pp. 5-34, figs. 3).—Extensive variety tests with long-staple upland cotton and Sea Island cotton at numerous centers in Georgia are reported in an effort to ascertain the varieties best suited for growing under boll-weevil and wilt conditions. For southern Georgia, Lewis 63, Desoto, Council-Toole, Dillon (for sandy soils), and Dix-Add are deemed best, while Cleveland, Toole, and Cook proved well adapted to most sections of northern Georgia.

How to grow cotton in spite of the boll weevil, I. W. WILLIAMS (*Ga. Bd. Ent. Bul.* 47 (1917), pp. 48, figs. 17).—The production of cotton from locally adapted, pedigreed seed under the best cultural conditions is recommended as the most effective method of combating boll-weevil and plant disease pests. Blooming records of a number of varieties tested at Thomasville and Valdosta, Ga., are reported.

Methods of treating cotton seed for anthracnose and angular leaf spot are noted.

Some lint characters of Sea Island cotton, S. C. HURLAND (*Agr. Jour. India* 12 (1917), No. 1, pp. 115-120).—This paper presents a brief discussion of such lint characters of Sea Island cotton as length, uniformity of length, weak fiber, and lint index and lint percentage, and their bearing on cotton selection. Summarized statements show the number of seeds necessary to be examined in respect to each character, and the probable error involved.

The author takes exception to the conclusions of Cook (*E. S. R.*, 20, p. 43), in so far as the latter maintains that a high lint percentage implies light seed, and hence that continuous selection for high lint percentage is inadvisable, as light seed gives rise to plants lacking in vigor. Observations with Sea Island cotton are noted, the author maintaining that high lint percentage does not imply a low seed weight, that plants with a low seed weight do not give rise to progeny deficient in vigor, and that cotton selections having a high lint index are usually found possessing a high lint percentage.

Notes on the destruction of cotton bushes by burning, F. R. SHEPHERD (*Agr. Jour. India*, 12 (1917), No. 1, pp. 120, 121).—This paper reports satisfactory results obtained with plowing under cotton stalks instead of burning them at La Guérte, St. Kitts. By pulling the stalks, rather than cutting them, and plowing them under from six weeks to two months previous to seedling, the risk of infection of the new crop with the leaf blister mite was apparently no greater than when the stalks were burned, while the soil derived marked benefit from the added organic matter.

Ten years' practical experience of Java indigo in Bihar, D. J. REID (*Agr. Jour. India*, 12 (1917), No. 1, pp. 1-26, pl. 1).—Statistical data are presented and discussed for each year from 1904 to 1915, inclusive, regarding the production of Java indigo (*Indigofera arrecta*) and of the local Sumatran strain in Bihar in an attempt to reestablish the industry on a satisfactory competitive basis with synthetic indigo production. Approved cultural practices and the nature and control of the wilt disease are briefly outlined.

Matkee, a green manuring plant, A. RAM (*Agr. Jour. India*, 12 (1917), No. 1, pp. 161, 162, fig. 1).—The leguminous weed matkee (*Eschynomene indica*) is briefly described, and its use as a green manure for tea estates and elsewhere outlined.

Culture tests with varieties of oats, 1909-1912, J. C. LARSEN (*Tidsskr. Planteavl*, 23 (1916), No. 5, pp. 701-756).—The results of cooperative culture tests with varieties of oats conducted for four years are reported in detail in tabular form and discussed. A description of each of the varieties tested is given. The results of the tests are summarized in the following table:

Results secured in cooperative variety tests of oats grown on clay and sandy soil.

Varieties.	Yield per tonde-land (1.36 acres).		Hull content.	Kernel weight.	Weight per tonde (4 bushels).
	Grain.	Straw.			
(Clay soil:	Cwt.	Cwt.	Per cent.	Mg.	Lbs.
Sejr.....	40.2	60.6	26.4	36	144
Schlanstedt.....	39.9	64.5	25.8	37	138
Byerne.....	39.7	54.8	25.6	34	137
Gul Næsgaard.....	39.1	60.0	25.3	38	140
Gulhvid Tystofte.....	38.9	60.3	27.1	34	140
Ligowo.....	37.4	55.8	24.7	38	143
(Sandy soil:					
Gras.....	27.3	43.8	35.3	31	109
Stjerne.....	26.6	36.8	26.4	33	126
Guldregn.....	24.9	40.8	25.6	32	135
Gul Næsgaard.....	24.7	40.4	26.1	37	124
Schlanstedt.....	24.7	42.6	27.3	38	125
Sejr.....	24.6	40.6	27.4	35	131
Gulhvid Tystofte.....	24.4	39.5	28.7	34	127
Ligowo.....	24.2	36.5	25.9	38	132

The chemical composition of the different varieties is also given.

Harvesting, picking, thrashing, and storing peanuts, H. C. THOMPSON (U. S. Dept. Agr., Office Sec. Circ. 81 (1917), pp. 6, figs. 4).—Methods which have proved successful are presented for harvesting, picking, and thrashing peanuts and for storing the product on the farm or in warehouses.

The potato, A. W. GILBERT, M. F. BARNES, and D. DEAN (New York: The Macmillan Co., 1917, pp. XII+318, pls. 16, figs. 29).—A book intended to give brief practical suggestions on the growing, breeding, and marketing of potatoes for both the farmer and the student. The chapters relating to breeding and varieties occupy a large proportion of the book, as these subjects are regarded as having received less attention in potato literature than cultural methods.

The application of correlation formulas to the problem of varietal differences in disease resistance.—Data from the Vermont experiments with potatoes, J. A. HARRIS (Amer. Nat., 51 (1917), No. 604, pp. 233-244).—A number of constants showing the relative correlation of disease resistance in potatoes to variety are reported. These figures were obtained by the author in connection with other studies involving a review of numerous experiments conducted by the Vermont Experiment Station in comparing varieties for susceptibility to early blight (*Alternaria solani*) (E. S. R., 31, p. 643), tuber rot (E. S. R., 17, p. 1078), and *Phytophthora infestans* (E. S. R., 29, p. 550).

The author maintains that the correlation coefficients presented justify much more definite conclusions than were drawn without such statistical analysis and, hence, demonstrate the usefulness of the biometric method in the preliminary stages of disease-resistance experiments, in which large numbers of varieties are being tested, and in which the mass of data is confusing. He concludes that the most careful individual analysis is not only desirable but essential, and that the statistical method should be supplemental.

Cooperative potato spraying, 1916, G. P. CLINTON and F. E. ROGERS (Connecticut State Sta. Rpt. 1916, pt. 5, pp. 355-364).—Spraying experiments conducted by the station and the New Haven County Farm Bureau in cooperation with farmers within the county to test the relative value of Bordeaux mixture and Pyrox in spraying Green Mountain potatoes for blight are reported. The estimated cost, yields, and gain or loss per acre for each treatment are shown in tabular form, and the conclusion is reached that homemade Bordeaux

was superior to Pyrox, due to the greater cost of the latter and the less beneficial results derived from its use.

The significance of hybrid selections with rice and how they are originated, L. KOCH (*Teyssmannia*, 27 (1916), No. 9-10, pp. 502-519, pls. 3).—Discussing the theory and practice of hybridization the author briefly reviews the work of Van der Stok (*E. S. R.*, 26, p. 435), begun in 1907, in hybridizing rice varieties.

Early rice planting as a means for augmenting the supply of irrigation water, W. L. MEZMAN (*Arch. Suikerindus. Nederland. Indië*, 25 (1917), No. 2, pp. 34-40).—The author presents data showing the saving in irrigation water made possible by the early planting (before October 15) of early-maturing varieties of rice on dry seed beds, withholding irrigation until after transplanting into the open field. An increase of profits of about 50 per cent is claimed for this practice.

Population analyses and inheritance studies concerning self-sterility, self-fertility, and sterility in rye, N. HERBERT-NILSSON (*Ztschr. Pflanzenzücht.*, 4 (1916), No. 1, pp. 1-44, figs. 3).—The author reports observations on 242 parent plants and 114 of their progeny, all of which were subjected to various methods of isolation. The study consisted of population analyses giving the average percentage of fertility (the number of kernels per number of glumes) of the variety and of the pedigree-populations and of inheritance studies where isolation had progressed through two or more generations.

Methods of isolation and isolating materials are briefly discussed. A part of the work was conducted with closed glass tubes (18 to 30 mm. in diameter) into which the spikes were inserted, the opening closed with cotton wrapped about the stem, and the glass tube fastened to a stake driven into the ground beside the plant. Other spikes were isolated by means of glass tubes the closed ends of which had been cut off and the opening covered with parchment. In order to compare glass- and parchment-isolation with "normal" isolation a few plants were grown in the open, where they were deemed adequately isolated by reason of the fact that the experimental plots were at least 2 km. distant from any other rye fields and the prevailing winds were from a direction from which there was no fear of foreign pollen infection.

Considerable data are presented to compare the different isolating methods. The setting of seed was noticeably depressed by artificial isolation, the average fertility amounting to 7 per cent for the normal, 4 per cent for the parchment, and 1 per cent for the glass-tube method.

Different populations exhibited certain peculiar differences in regard to the average fertility percentage, while hybrid populations were even more variable than the parent and attained a higher fertility percentage. This was illustrated in the hybrid strains Brattingsborg \times Petkuser and Brattingsborg \times Heinrich, which gave an average fertility percentage of 7.7 with normal isolation and 2.6 with glass-tube isolation. Petkuser populations, on the other hand, and individual selections from Petkuser and Brattingsborg gave an average fertility of 0.5 per cent with glass-tube isolation and 3.8 per cent with normal isolation.

Inheritance studies demonstrated that rye populations contain strongly self-sterile, partly self-sterile, and self-fertile individuals. In the population receiving the most exhaustive study, an individual selection of Petkuser rye, of 73 plants observed 71 were self-sterile, 1 partly self-sterile, and 1 self-fertile. The appearance of a self-fertile race was held to indicate that the character of self-fertility was monohybrid, with self-sterility dominant. Self-fertile races must therefore be immediately constant upon their appearance, this having been demonstrated in one race through three generations. The self-fertile plant mentioned above had a fertility percentage of 74.8 with normal isolation. Its

progeny showed 57.4 per cent fertility with normal isolation and 14.8 per cent with glass-tube isolation. Four races have been observed which can be expected to show as high fertility. Normal fertility with Petkuser rye from cross-pollination, according to Ulrich (E. S. R., 14, p. 756), is 80 per cent.

Plants were also found which showed a high fertility percentage but somewhat lower (10 to 20 per cent) than that for the races noted above. These strains, however, have been observed through only two generations and consist of a small number of individuals. The author suggests that such plants be designated as "half-fertile" to distinguish them from those of higher fertility.

Individual plants setting from 10 to 20 per cent of seed have been observed to produce only self-sterile progeny. They are to be considered, therefore, as partly fertile modifications, or as extreme plus-variants of ordinary self-sterility. Only through inheritance studies, therefore, is the genotypic nature of partly fertile plants to be determined. Modifications which show such high percentages of fertility as that of the high-fertility races have not been observed.

The fertility percentage of high-fertility races did not appear to be depressed by isolation, although a marked retrogression in the quality and vitality of the seed and in the vitality of the progeny was observed. The plants remained rather vigorous after the second isolation but after the third were almost dwarfed. Whether strains of high self-fertility could be maintained for agricultural purposes is still regarded as questionable. These races have the advantage of being practically independent of meteorological conditions, but in every case observed the inferior quality of grain occasioned by isolation has been permanently established in the cross-pollinated progeny so that any advantage is apparently accompanied by this serious disadvantage. The author concludes, however, that differences between these races, in respect to this character, may be encountered, and that through hybridization the vitality of the race might be established without losing the advantages of self-fertility. The progeny of such a hybrid must be constantly self-fertile, since it arises from races having the same recessive character.

The author notes the progress of experiments planned for further study of the inheritance of sterility in an effort to determine whether this character lies solely in the ovule or is also expressed in the pollen grain.

Grain sorghum seed, E. B. BABCOCK (*California Sta. Circ. 177 (1917), pp. 8, figs. 6*).—This is a popular discussion of the principles and methods of seed selection for the improvement of grain sorghums, together with simple directions for field selection and for testing individual plant selections.

The purification of soy bean varieties, D. F. JONES and H. K. HAYES (*Connecticut Sta. Rpt. 1916, pt. 5, pp. 348-353*).—Variations in plant habit and in flower and pod color observed in a variety of soy beans grown at the station in 1913 led to individual plant selections within the variety during 1914. Differences in height, number of pods, color and shape of seed, yield, time of flowering, color of flowers, and habit of growth were noted for 23 selections. Similar observations of selected plants within a strain grown as Ito San indicated that the variety was quite pure.

It is concluded that "these results simply show that a mixed variety of soy beans can be purified and made uniform by selecting individual plants and increasing their progeny."

Harvesting soy-bean seed, W. J. MORSE (*U. S. Dept. Agr., Farmers' Bul. 886 (1917), pp. 8, figs. 7*).—Directions are given for harvesting, curing and handling, thrashing, and storing soy beans when grown for seed.

The sugar beet in Algeria, VERMEIL (*Bul. Agr. Algérie, Tunisie, Maroc, 22 (1916), No. 2-6, pp. 29-34*).—A general discussion of sugar beet production in Algeria, together with tabulated data comparing six varieties.

The action of copper arsenate and arsenious acid on sugar cane roots. E. JARVIS (*Queensland Agr. Jour., n. ser., 7 (1917), No. 2, pp. 79, 80*).—This is a preliminary report of the effect of copper arsenate and arsenious acid on sugar cane roots when used as a poison bait for grubs.

Short "sets" of "badilla" cane planted in earthenware pots, representing treatments of 113 and 226 lbs. of Paris green per acre, produced shoots which at the end of six weeks averaged 10 in. in height as compared with 7.5 in. for untreated checks. A maximum growth of 27 in. was attained in the pot representing a 226-lb. application. The average height of cane attained after six weeks' growth with from 100- to 200-lb. applications of commercial white arsenate was 27.8 in., as compared with 26 in. for the untreated check.

Concerning the progeny of plus and minus variants from pure lines of tobacco, H. JENSEN (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 24 (1916), pp. 41-56, pls. 2; abs. in Internat. Inst. Agr., Internat. Rev. Sci. and Pract. Agr., 8 (1917), No. 5, pp. 720-722*).—Observations are reported on the offspring of large and small plants (3.9 to 7.3 ft. in height) and of wide and narrow-leaved plants.

The results with different-sized plants indicated that large and small mother plants of a pure line produce offspring of the same height. Two pure lines were observed in regard to leaf width, one producing offspring which fluctuated around the parent plant (that is, around the plus or minus variants), while plus variants of a pure line, known as the WY-line, produced offspring having as narrow leaves as the minus variant.

Planting tests with tobacco, O. DE VRIES and E. SIDENIUS (*Proefstat. Vorstenland. Tabak. [Dutch East Indies], Meded. 27 (1916), pp. 85*).—This reports tests to determine the effect of different planting distances upon (1) yield as expressed by grams per plant, kilograms per plat, and percentage of first-length leaves, and (2) quality and color. The tests were conducted at a number of centers from 1910 to 1915 and included seven different planting distances.

The results obtained indicated that the yield per plant was least with close planting, while the greatest variation in individual plants was obtained in the wide plantings. The highest yield per plat was obtained from close plantings. Greater leaf length was obtained from wide plantings. In regard to quality and color, the best results were reported from close plantings on good soils, the improved quality and color, together with increased yield, fully compensating any loss in length.

[Report of field experiments with tobacco, 1898-1911], M. RACIBORSKI, H. JENSEN, and O. DE VRIES (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 5 (1913), pp. 79-121, 131-136, 138-196, 199-215, pls. 14, figs. 6*).—Selections within pure lines, the testing of new varieties, and hybridization studies are reported, the latter being discussed at some length and the results obtained from numerous crosses illustrated. Extensive field experiments are reported pertaining to the seed, development of the seedling, various systems of seed-bed management, studies of the plant in the field, green manuring, use of stable manure, irrigation, influence of different factors on tobacco culture, fermentation studies, and combustion studies.

A report of tobacco studies near Deli, O. DE VRIES (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 6 (1914), pp. 20-30*).—Climatic conditions, cultural practices, fermentation processes, and marketing facilities encountered in the course of tobacco investigations near Deli are briefly reviewed.

Tobacco culture, R. A. W. SOESMAN (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 13 (1915), pp. 10, pls. 4*).—Field practices in tobacco cultivation on the Crown lands of the Dutch East Indies are described in some detail.

The influence of green light upon the drying of tobacco leaves. H. JENSEN (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 10 [1914], pp. 14-22, fig. 1*).—Laboratory and field experiments are outlined for the purpose of determining the relative influence of white and green light upon the curing of the lower and upper leaves of tobacco as compared with leaves cured in darkness.

The general conclusion is drawn that light has comparatively little influence on the quality and color of the leaf, and that its importance has been greatly overestimated. Average percentages of brown leaves in samples of lower leaves are given at 74.87, 75.69, and 77.5 for white, green, and dark chambers, respectively. Similar data for samples of upper leaves show 90.98, 90.37, and 89.45 per cent of brown leaves.

Observations on the combustion of tobacco. E. SIMONIUS (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 22 (1916), pp. 25-69, pls. 2; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 8, p. 1119*).—Chemical analyses of the ash from good and poor qualities of tobacco and from the lower, middle, and top leaves of plants grown at different points are presented in tabular form, together with numerous fertilizer tests on field plots and with individual plants, and irrigation tests.

The general conclusion was reached that the properties of the soil and climate have a predominating influence on combustibility which special fertilizer treatment does not remedy. In one case reported potassium fertilization gave good results, but required such large amounts of fertilizer (20 gm. of potassium nitrate per plant) as to be practically prohibitive. Injection of potash salts into plants was without positive results. Application of horse manure in one experiment produced a serious decrease in combustibility.

Analyses of the leaves from different parts of the plant showed that combustibility was highest in the bottom leaves, decreasing as the top leaves were approached. This was specially true when the rains did not occur until late in the season. Supplementary irrigations were found to occasion considerable loss in combustibility.

Tests of winter wheat (*Connecticut State Sta. Rpt. 1916, pt. 6, pp. 428, 429*).—The following varieties of wheat have proved to be hardy when exposed to severe winter conditions in Connecticut: Dawson Golden Chaff, Fultz, Maryland Flint, Dietz Longberry, Early Genesee Giant, Rocky Mountain, Jones Winter Fife, Bearded Winter Fife, New Amber Longberry, Martin Amber, Poole, Fultz-Mediterranean, Mammoth Red, Stover, and Klondike.

Wheat, C. F. NOLL (*Pennsylvania Sta. Bul. 148 (1917), pp. 3-15, fig. 1*).—Tests with 13 varieties of winter wheat for the 10-year period of 1906-1916 and with 33 varieties and selections for the period of 1913-1916 are reported, and the varieties briefly described in tabular form. Milling and baking tests conducted during 1910 and 1914-1916, inclusive, are also noted.

Dawson Golden Chaff gave the highest average yield for the 10-year period, amounting to 34.5 bu. per acre, while Fulcaster Selection 44-09 was highest for the shorter period, with an average yield of 40.4 bu. per acre. Harvest King, with 31.9 bu., and Currell Prolific, with 40 bu. per acre, respectively, were second for the two periods, while Fultz gave the lowest average yield for the 10-year period, 29.7 bu., and Eclipse for the shorter period, 28.5 bu. per acre.

In the milling and baking tests, the flour from most of the varieties is said to have compared favorably with standard spring patent flour in bread-making qualities and yield. The 1910 tests included Dawson Golden Chaff, Reliable, and Fulcaster, the last-named making the largest loaf and giving the best quality of bread.

Tests with Miracle wheat in 1912 sown at 1- and 2-bu. rates gave yields of 25.5 and 30.8 bu. per acre, respectively. In 1914 other samples of the same variety, designated as Marvelous, were sown at 1-, 3-, 6-, and 8-pk. rates and yielded 23.8, 33.1, 36.5, and 34.8 bu. per acre, respectively. The variety failed to tiller more than the majority of the other varieties tested.

Marquis and Minnesota 160 spring wheats were sown in 1915 and 1916 and gave average yields of 13.1 and 13.2 bu. per acre, respectively. In 1916, 32 commercial varieties of oats were grown with the wheats, giving an average yield of 70.1 bu. per acre. Winter wheat grown these two years averaged 32.6 bu. per acre for 30 commercial varieties. The spring wheat is said to have been shrivelled and of poor quality and is deemed unsuited for Pennsylvania conditions.

Wheat culture in Pennsylvania is outlined and the principal insect and disease enemies of the crop briefly discussed.

Wheat culture, T. B. HUTCHESON and T. K. WOLFE (*Virginia Sta. Bul.* 215 (1917), pp. 15, figs. 3).—Approved methods of wheat production are outlined and limited tests noted with dates, rates, and methods of seeding and with fertilizers.

Fulcaster, Dietz Amber, and Stoner bearded wheats and Fultz, Leap Prolific, and Harvest King smooth varieties are deemed best for Virginia conditions.

Seed treatments for the loose and stinking smuts of wheat are noted.

Wheat growing in the Southeastern States, C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul.* 885 (1917), pp. 14).—An increased acreage of wheat is recommended for Tennessee, North Carolina, Mississippi, Alabama, Georgia, and South Carolina as a means of crop diversification and of providing home-grown bread. The sandy loam, silt loam, loam, and many clay soils when drained, well tilled, and fertilized are deemed suitable for wheat production, while the lighter, sandy soils, especially in the Coastal Plain, are regarded as better adapted for rye. The soft, red, winter wheats are thought best from all standpoints. Crop pests (insects, diseases, and weeds) are briefly noted and approved methods of control outlined. The value of wheat as a nurse crop, for hay, and for fall and winter pasture is also indicated.

[Cultural experiments with wheat growing], W. J. SPAFFORD (*Jour. Dept. Agr. So. Aust.*, 20 (1916), No. 4, pp. 278-280; 20 (1917), No. 7, pp. 550, 551).—Experiments conducted by T. Griffin since 1908 with different cultural treatments of wheat grown under dry-farm conditions are briefly reported.

The results for the period of 1908-1915 indicated that on subpacking land before seeding there was no increase over land not subpacked, and that with subpacking immediately after plowing the average increase in yield was only 1 bu., not deemed sufficient to encourage the practice. Tests in 1915-16 included a comparison of rolling and subpacking on 6-in. plowing and on 3-in. plowing, and of land cultivated at plowing time and then treated as ordinary plowed fallow. The results for 1916 indicated that there was practically no difference in yield between subpacking and rolling, the yields being approximately 20.6 and 19.8 bu., respectively, for the 6-in. plowing, and 18.06 and 18.7 bu., respectively, for the 3-in. plowing. Land cultivated at plowing time and treated as fallow gave a yield of 17.2 bu.

The seeds of cultivated plants and their identification, L. FRANCOIS (*Ann. Sci. Agron.*, 4, ser., 4 (1915), No. 1-6, pp. 30-55; 5 (1916), No. 1-6, pp. 207-235, figs. 121).—This is an extensive discussion of the functions of the seeds of cultivated plants, together with tables and illustrations for their identification.

Report of seed tests for 1916, C. H. WALDRON and ALMA I. STONE (*Bul. N. C. Dept. Agr.*, 37 (1916), No. 9, pp. 74).—A detailed report of the analysis of 1345 samples of farm seeds and 372 samples of vegetable seeds for the year 1915-16

Heating seed rooms to destroy insects, E. G. MONTGOMERY (*Jour. Amer. Soc. Agron.*, 9 (1917), No. 3, pp. 105-108, fig. 1).—This paper describes a method for heating seed rooms to destroy insects, as devised and used by the department of farm crops at Cornell University. By using half-bushel grain receptacles having perforated metal tops and bottoms a temperature of 120° F. can be attained in a half bushel of grain within 5 to 6 hours with a room temperature of 130°. The treatment was found sufficient to kill mice as well as insects in all stages of development without any injury to the germinability of the grain.

HORTICULTURE.

Saving vegetable seeds for the home and market garden, W. W. TRACY, SR. (*U. S. Dept. Agr., Farmers' Bul.* 884 (1917), pp. 16, figs. 5).—This publication gives directions for saving the seed of our garden vegetables. The subject matter is discussed under the general headings of present shortage of vegetable seeds, how the supply may be increased, plants which bear seed the year they are planted (annuals), plants which require a winter rest before producing seed (biennials), and labeling, fumigating, and storing vegetable seeds.

Control of diseases and insect enemies of the home vegetable garden, W. A. GIBBS and F. H. CHITTENDEN (*U. S. Dept. Agr., Farmers' Bul.* 856 (1917), pp. 79, figs. 82).—This publication discusses plant diseases and insects, prevention of diseases and insect infestation, formulas for fungicides and insecticides, mechanical methods of control, spraying methods, general crop pests and diseases, and the principal garden crops and the insects and diseases that attack them.

[Experiments with vegetables] (*Pennsylvania Sta. Bul.* 147 (1917), pp. 31-44, figs. 3).—A brief statement of progress made in investigations with cabbage, tomatoes, and asparagus, essentially the same as that noted in the previous report (*E. S. R.*, 38 p. 40).

Home storage of vegetables, J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul.* 879 (1917), pp. 22, figs. 20).—A popular treatise including directions for constructing storerooms and outdoor storage cellars, together with specific information for storing different kinds of vegetables and also apples.

First generation crosses in cucumbers, H. K. HAYES and D. F. JONES (*Connecticut State Sta. Rpt.* 1916, pt. 5, pp. 319-322, pl. 1).—An experiment to test the value of first generation crosses of cucumbers was started in 1912 when the following crosses were made: Early Russian×White Spine, White Spine×London Long Green, London Long Green×Fordhook Famous, and Fordhook Famous×White Spine. In view of the prevalence of mosaic disease in 1914 and in 1915, only the preliminary results secured in 1913 are given here.

The results for one season indicate that first generation cucumber crosses may be expected to exceed the higher yielding parent in yield. The only cross that did not exceed the average of the parents in any character by an appreciable amount was the London Long Green×Fordhook Famous cross. The plants of this cross produced the same type of vine and same size of fruit, whereas the other three crosses were between parents differing in vine habit and in size of fruit.

Melon growing in Indiana, H. J. REED (*Indiana Sta. Circ.* 68 (1917), pp. 16, fig. 14).—This circular discusses the present status of the cantaloup and watermelon business in Indiana, and gives suggestions relative to their culture, harvesting and marketing, varieties, and the control of insects and diseases.

The effects of cross- and self-fertilization in tomatoes, H. K. HAYES and D. F. JONES (*Connecticut State Sta. Rpt.* 1916, pt. 5, pp. 305-318, pls. 2).—The

object of the experiment here reported was to test the value of first generation crosses in tomatoes and the effects of continued self-pollination within the variety. Four commercial varieties of tomatoes were used in the experiment, which was carried on during the four seasons 1912 to 1915.

The successive generations of self-fertilization reduced progressively both the yield and size of fruit in Best of All. The variety Stone was reduced in yield and increased in size of fruit, Dwarf Champion remained reduced in fruit size and increased in yield, and Lorillard remained increased in both fruit size and yield throughout the experiment. From these results it is concluded that self-fertilization of tomatoes simply isolates genotypic lines which may or may not exceed the original variety.

First generation crosses of Stone×Dwarf Champion and of Lorillard×Best of All were made each year. The Stone×Dwarf Champion crosses showed an average annual increase in weight of fruit and also in number of ripe fruits per plant of 8 per cent over the parental average and approached the fruit number of the better parent. The Lorillard×Best of All crosses showed an average annual increase in weight of fruit of only 3 per cent and no increase in number of ripe fruits over the parental average.

The increases in both size and number of fruits for the Stone×Dwarf Champion crosses ranged from 11 to 17 per cent during the four years and were sufficient to make the practice of growing first generation tomato crosses commercially profitable. These results, considered in connection with the less favorable results secured with the Lorillard×Best of All crosses, led to the conclusion that not all combinations of tomato varieties give the vigor usually derived from crossing, but when a desirable combination is found it can be counted on to give the increase in yield every time the cross is made.

Vigor due to crossing as measured by increased yield was not appreciably greater in crosses between artificially selfed parents than in crosses between ordinary commercial varieties. With the Stone×Dwarf Champion crosses, hybrid vigor also advanced the time of production before that of the earlier parent, thereby producing an opposite effect to that produced by favorable environmental conditions, which tend to delay maturity.

Report of orchard work on Mount Carmel Experiment Farm for years 1911 to 1916, inclusive, E. M. STODDARD (*Connecticut State Sta. Rpt. 1916, pt. 5, pp. 365-377*).—This comprises a statement of orchard work done by different departments of the station on the Mount Carmel farm for the years 1911 to 1916. The data given include a record of spraying, fertilizers, cover crops, cultivation, yield of fruit, and expenses and income in connection with the rejuvenation of a small old apple orchard. Similar data are also given for small apple and peach orchards started in 1911.

A comparison of different forms and combinations of phosphoric acid is being conducted in the peach orchard. The results thus far secured indicate that acid phosphate gives the highest yield and that lime is detrimental to the production of fruit.

Irrigation of orchards, S. FORTIER (*U. S. Dept. Agr., Farmers' Bul. 882 (1917), pp. 40, figs. 39*).—A revised edition of Farmers' Bulletin 404 (E. S. R. 23, p. 440).

Experiments in the irrigation of apple orchards, E. P. TAYLOR and G. J. DOWNING (*Idaho Sta. Bul. 99 (1917), pp. 48, figs. 24*).—This bulletin describes experiments in the irrigation of apple orchards conducted in an apple orchard at Payette, Idaho, during the years 1913 to 1915, inclusive, and in an orchard at Twin Falls during the years 1914 to 1916, inclusive. In conducting the experiments special attention was given to the determination of the most economical amount of water to mature an apple crop, the relation of irrigation to the

formation of fruit buds, proper irrigation systems to produce apples of best keeping quality, the best irrigation scheme for the production of relatively large amounts of extra fancy and fancy fruits, and the influence of soil moisture upon the health of the tree as indicated by winter injury and blight. The results of the experiments are presented in a series of tables and charts and fully discussed. The investigation as a whole is summarized as follows:

-The trunk of an apple tree makes its growth during the first part of the growing season. By August 1, 75 per cent of the total season's growth is completed. A cover crop greatly checks the rate of growth of the trunk. The trunk growth of Jonathan apple trees is directly affected by the amount of irrigation water applied during the first part of the growing season and by the percentage of water in the soil the preceding dormant season (winter). The latter factor may easily overbalance in its effect the former one.

-The terminal (limb) growth of Jonathan apple trees is practically completed by the first part of July. No growth is made after July 15. Irrigation after this date has no effect on the wood growth of the tree. As a general rule, the more irrigation water applied before July 1, the greater the terminal growth although the percentage of moisture in the soil the preceding fall and winter probably affects the terminal limb growth. A cover crop in an orchard greatly checks the limb growth of the trees.

-Jonathan apples grow very slowly from the time they are formed until about July 15, completing less than 30 per cent of their total growth during the first half of the total period they hang on the trees. Irrigation during this period (before July 15) will not increase the size of the apples. Jonathan apples grow most rapidly during the period starting about July 15 and ending about two weeks before picking time, when the rate of growth becomes considerably slower. Irrigation during this period of rapid growth has a very decided effect in increasing the size of the apples although it has practically no effect on the wood growth of the tree.

-Heavy irrigations in the spring tend to increase the wood growth of an apple tree and this tends to increase fire blight. A cover crop, preferably alfalfa, greatly decreases the wood growth and so lessens the amount of blight.

-Winter injury to apple trees, especially young trees, is usually the result of the wood of the tree not being thoroughly ripened or due to the ground being too dry during the winter. It is advisable to hold the water off during the latter part of the summer and let the wood ripen; then, if the fall is excessively dry, to apply a late dormant irrigation just before the ground freezes. Chlorotic or bunches of white leaves on apple trees is often a sign of overirrigation.

-Where two plats were given an equal total amount of water for the season, one early during the vegetative period of the tree and the other later during the fruit developing season, the last mentioned system invariably produced much the larger apples. Plats irrigated heavily early in the season produced heavy foliage which was detrimental to the development of color on the apples. Plats which were not forced to excessive leaf and wood growth during the vegetative period by early irrigation gave better color to the apples when liberal applications of water during the period of most rapid apple growth. This experiment shows that fruit growers may, by irrigation, very materially augment color in fruit production if the water is applied at the right time. The plat which was given little irrigation early in the season (before July) and liberal applications during the period of most rapid apple growth (from July until two weeks before picking time) gave the highest percentage of extra fancy and fancy grades and also fruit of the best storage qualities. This plat (at Twin Falls, Idaho) with a dense clover cover crop was given a little over 2-acre feet of water during the entire season. An even

amount of water increasing as the season advanced to about two weeks before picking time gave apples of the best keeping qualities without sacrificing any of the crispness so essential to good apples.

"A dormant irrigation applied in the late fall just before the ground freezes is very essential and beneficial in most of the irrigated fruit districts of Idaho. From the time that the apples are picked until this time, the orchard should be allowed to dry out in order that the wood of the trees may become thoroughly ripened. The percentage of soil moisture in the late fall affects the percentage during the entire winter and early spring following. If an orchard is given this late dormant irrigation in the fall, the first irrigation the following spring may be put off considerably later than if the orchard went into the winter in a dry condition. This fall irrigation is very desirable.

"On the sandy soil in the Payette Valley, in a full bearing orchard of Winesaps and Jonathans with a clover cover crop, about 3 acre-feet of water per season gave the maximum results considering yield, grade, color, size, keeping qualities of the fruit, and the health of the tree. Here, also, the best results from the application of water were obtained when most of it was applied during the period of greatest apple growth."

Results from orchard fertilization (*Pennsylvania Sta. Bul. 147* (1917), pp. 34-37, fig. 1).—This comprises a brief summary of the results secured during the nine-year period from the orchard management experiments started by the station in 1907 (E. S. R., 35, p. 540; 38, p. 42).

The fertilizer experiments have shown in general that nitrogen is likely to be of most importance in orchards for improving both yield and growth. Thus far the nitrogen from commercial sources or from stable manure has proved more effective than that from cover crops. When slow-acting carriers of nitrogen are used no immediate effects should be expected before the following year. As indicated by experiments conducted elsewhere, applications of nitrate of soda about the time the buds are starting into growth in the spring or slightly later may materially influence the crop of the current season.

Neither phosphorus nor lime when used alone has exerted any important influence on either the yield or growth of apples in these experiments. The addition of phosphorus to nitrogen, however, has generally proved very beneficial. The gains from this combination in certain cases have exceeded 200 bu. per acre annually for the last nine years. It is pointed out that lime may be indirectly beneficial at times through its favorable influence on the growth of leguminous cover crops.

The rate of application now recommended for an acre of bearing trees consists of 150 to 200 lbs. of nitrate of soda and 250 to 300 lbs. of acid phosphate or their equivalents. For younger trees which are less likely to respond to fertilizers a good mulch of stable manure at the rate of 8 tons per acre is recommended. Potash has proved of material benefit in only one experiment. Fifty lbs. of the high grade muriate or its equivalent is now considered ample for an acre of bearing trees.

No fertilizer has materially improved the color of the fruit and those containing nitrogen have generally reduced it. This is probably due to delayed maturity, which has an advantage in the case of the more northern varieties, such as Baldwin, Hubbardston, and McIntosh, when grown in Pennsylvania. Lack of color in these varieties is readily overcome by delaying the picking. With varieties requiring a long growing season, such as the York Imperial, it may be necessary to utilize other aids to color, such as open pruning and sod culture, in order to overcome the detrimental effects of nitrogen. In certain orchards no kind of fertilization has yet proved beneficial.

The results secured from tests of cultural methods and cover crops in apple orchards during the last nine years indicate that in the absence of fertilization the mulch method generally gives the largest growth and the most fruit in young orchards, while the tillage and cover crop method has done slightly better in mature orchards. The greater efficiency of the mulch on the young trees is apparently connected with its greater moisture-conserving effects. In many cases the mulch can be readily grown between the tree rows in young orchards by the use of alfalfa and possibly also by the use of other plants. By this method many of the sloping foothill lands of the State which are not well adapted for tillage may be satisfactorily utilized in the production of fruit.

In the presence of proper fertilization there has been comparatively little difference in efficiency in tillage, tillage and cover crops, and proper sod mulch in their effects on the yield and growth of apples. Even the sod treatment when accompanied by fertilization of the right kind has been very satisfactory in many cases. Among the annual cover crops hairy vetch, soy beans, oats and Canada peas, buckwheat, and millet are now showing the best results in the order named. As compared with tillage alone, the addition of annual cover crops does not reveal much benefit, except possibly in seasons of abundant rainfall. The use of tilled intercrops with the appropriate fertilization followed by a winter cover crop of rye or rye and vetch has proved very satisfactory in the development of young orchards and has resulted in no apparent injury to the trees during the first nine years. Potatoes have done especially well in this connection and field beans, buckwheat, early cabbage, tomatoes, and other vegetables are believed to be worthy of special consideration in localities suited to their profitable production.

The planting and care of the young apple orchard, H. J. REED (*Indiana Sta. Circ. 67 (1917), pp. 20, figs. 14*).—This circular contains practical suggestions relative to the cost of establishing an orchard, selection of varieties adapted for the home orchard and the commercial orchard, selection of nursery stock, preparation of the soil, planting operations, methods of pruning the young tree, and care of the young orchard.

Seed production in apples, C. S. CRANDALL (*Illinois Sta. Bul. 203 (1917), pp. 185-213, figs. 8*).—As a first step in a study of seed production in apples, this bulletin records the number of seeds produced in 31,972 individual fruits comprising the following four groups of apples, namely, large apples of orchard varieties, small apples of orchard varieties, crabs, and hand-pollinated fruits. Thirty-two orchard varieties and 25 species and varieties of the genus *Malus* are represented.

A study of the data as a whole shows that the average number of seeds in large apples of orchard varieties was 8.27; for small apples, 7.21; and for crab-like forms of *Malus*, 4.22. "The range in average seed production as exhibited by different varieties is wide with both orchard varieties and crab-like forms. Departures from the normal of five carpels to each fruit occur with both orchard varieties and crab-like forms, but are much more frequent with crabs than with orchard fruits. There are wide differences among individual varieties and species in seed-producing capacity, and the range in numbers of seeds in individual fruits is also wide. The assumed normal of 10 seeds to each fruit is likely to occur in a small percentage of orchard fruits, but rarely occurs in crab-like forms. Capacity to produce seeds appears as a varietal characteristic.

"Parthenocarpic fruits occur in orchard varieties and in species of *Malus* but not in very great numbers. There is great regularity in the appearance of ovules in normal numbers, that is, two in each carpel. Few cases of suppression of ovules occur; numbers in excess of normal are more common among orchard varieties than among crabs.

"Comparison of seed production in fruits developed from flowers open to pollination by insects and in fruits from hand-pollinated flowers brings out only small differences; apparently seed production is not dependent upon the manner in which pollination is effected. Considerable differences appear in seed production of individual fruits and of particular varieties, but averages of groups warrant the conclusion that the more highly developed orchard varieties exceed crabs in seed production and that, as between large and small fruits, large fruits produce the greater number of seeds."

The packing of apples in California, W. P. TUTTS (*California Sta. Circ. 178* (1917), pp. 31, figs. 21).—A practical treatise on packing house methods and equipment, with special reference to the box packing of apples.

Peach growing in Indiana, J. OSKAMP (*Indiana Sta. Circ. 69* (1917), pp. 24, figs. 15).—A practical treatise discussing the location of the orchard, planting, soil management, pruning, rejuvenation, varieties, winter and summer spraying, and enemies requiring special treatment.

Strawberry varieties and cultural hints, J. OSKAMP (*Indiana Sta. Bul. 200* (1917), pp. 3-16, figs. 14).—This bulletin briefly discusses the methods of growing, harvesting, and marketing strawberries, and gives a descriptive list of varieties that have been tested at the station grounds and directions for the control of insect pests and diseases.

Varieties of blackberries and raspberries with notes on their care, J. OSKAMP (*Indiana Sta. Bul. 201* (1917), pp. 3-12, figs. 6).—This circular contains popular instructions for the culture and care of blackberries and raspberries, including a descriptive list of varieties tested for five years at the station. Those varieties which have proved generally satisfactory over the State are indicated.

Mint growing in northern Indiana, C. B. SAYBE (*Indiana Sta. Circ. 65* (1917), pp. 14, figs. 8).—This circular deals with the culture of peppermint and spearmint in northern Indiana. It includes a discussion of soils, the establishment and care of a new plantation, harvesting, distilling the mint, disposal of the steamed bay, treatment of the field after harvesting, maintaining an established plantation, duration of a plantation, yields and returns, and insect pests and diseases.

FORESTRY.

[Report of the forestry section] (*Proc. 2. Pan Amer. Sci. Cong., 1915-16, vol. 3, pp. 481-502, 796-812, 815-834*).—The following papers read before the Second Pan American Scientific Congress, held at Washington, D. C., December 27, 1915, to January 8, 1916, are here presented in full: A Report on Forest Exploration in Southern Patagonia, by C. M. Hicken (pp. 481-483); South American Forest Resources and Their Relation to the World's Timber Supply, by R. Zon (pp. 483-492); The Lesson of Forestry in the Philippine Islands, by G. P. Ahern (pp. 492-502); The Attitude of the Government in the Matter of National Forests; Relation of Forest Culture to the Future Development of Central and South America, by E. L. Quirós (pp. 796-800), by R. Brin (pp. 801-805), and by H. Echegoyen (pp. 805-812); Forest Problems and Economic Development in South America, by R. Zon (pp. 815-822); and Scientific Forestry for Latin America, by B. Moore (pp. 822-834).

Report of the forester for 1916 (*Connecticut State Sta. Rpt. 1916, pt. 6, pp. 379-382*).—Data as to forest fires in 1916 are summarized.

Report of committee on forests, C. LEAVITT (*Com. Conserv. Canada Rpt., 8* (1917), pp. 193-208, pls. 2).—A review of various forest activities in Canada during 1916.

Annual return of statistics relating to forest administration in British India for the year 1915-16 (*Ann. Return Statis. Forest Admin. Brit. India, 1915-16, pp. 25, pl. 1*).—A statistical review for the year 1915-16 relative to the administration and management of the State forests of British India. A statement showing the revenues, expenditures, and surplus of the forest department throughout India during the 25 financial years from 1891-92, together with a diagram showing the annual forest revenues, expenditures, and surplus for the last 10 years, is included.

State forestry report for the year ended March 31, 1917, T. N. BRODRICK ET AL. (*Ann. Rpt. Forestry Branch, Dept. Lands and Survey, New Zeal., 1917, pp. 41*).—A report on the administration and management of the State forests, nurseries, and plantations in New Zealand, including data on the timber cut, imports and exports, revenues, expenditures, etc.

A forest survey of the town of Redding, Conn., A. E. MOSS (*Connecticut State Sta. Rpt. 1916, pt. 6, pp. 383-427*).—This report embraces the results of an intensive survey of the town of Redding, Conn., undertaken in the summer of 1915. Information is given relative to the commercial tree species, forest types, and character of the forest in different areas, together with suggestions relative to fire protection, improvement cuttings, and reforestation.

New Philippine shrubs and trees, E. D. MERRILL (*Philippine Jour. Sci., Sect. C, 12 (1917), No. 5, pp. 263-303*).—The present paper consists, for the most part, of descriptions of 45 presumably new species of Philippine trees and shrubs.

Silvicultural notes on forest trees of Queensland (*Dept. Pub. Lands, Queensland. Forestry Bul. 3, pt. 1 (1917), pp. 27, pls. 4*).—This is the first of a series of bulletins dealing with the silviculture of the more important forest trees of Queensland. Ten species are considered in the present bulletin.

The forests and woods of Gabon, A. CHEVALIER (*Vég. Utiles Afrique Trop. Franç., No. 9 (1917), pp. VII+470, pls. 28, figs. 32*).—This comprises the results of an economic survey of the forests of Gabon, French Congo, undertaken in 1912. The introductory chapters deal with the history of investigations of the flora of Gabon, the development of commerce in woods, and the discovery of the principal economic species. In the succeeding chapters the forests are described with reference to soil, climate, and distribution; the species observed are considered with reference to their nomenclature, distinguishing characteristics, economic uses, and habitat; and the woods are further classified according to their density and principal uses. The work concludes with suggestions relative to the establishment of a forest service in Gabon.

Notes on the timbers of Lukolela and of Eala, E. LEPLAE (*Bul. Agr. Congo Belge, 8 (1917), No. 1-2, pp. 99-101, fig. 1*).—The principal timbers of Lukolela and Eala on the Kongo are here classified according to their density.

A note on thitsi, *Melanorrhœa usitata*, with special reference to the oleoresin obtained from it, E. BENSKIN and A. RODGER (*Indian Forest Rec., 6 (1917), No. 3, pp. 31, pls. 5*).—An account of this species with reference to its common names, distribution and habitat, characteristics of the tree and timber, natural and artificial regeneration, method of tapping the trees, uses of the oleoresin, lacquer work of Burma, laboratory experiments, yield per tree and cost of extraction, and outturn from various parts of Burma and prices.

The influence of thinning out *Hevea* fields on the rubber yield per acre, P. ARENS (*Arch. Rubbercult. Nederland. Indië, 1 (1917), No. 4, pp. 234-241; Ned. Proefstat. Malang, No. 19 (1917), pp. 7*).—Some data are given which indicate that rubber trees planted as close as 12 by 12 and 12 by 24 ft. may be thinned out to a distance of 24 by 24 ft. and thereby reduce the cost of tapping without any material decrease in yield per acre of rubber.

Note on the cubage of a sample plat in the virgin forest of Yangambi, central Kongo. E. LEPLAË (*Bul. Agr. Congo Belge*, 8 (1917), No. 1-2, pp. 89-98, pl. 1, fig. 1).—Height, circumference, and volume data are given for the standing crop on about five acres of forest, including over 50 different species.

A new dendrometer. D. BRUCE (*Univ. Cal. Pubs. Agr. Sci.*, 3 (1917), No. 4, pp. 55-61, figs. 3).—The dendrometer here illustrated and described consists essentially of a straight arm upon which are mounted two small mirrors, both at an angle of 45° with the axis of the arm, parallel to each other and facing in opposite directions. One mirror is fixed at one end of the arm, while the other is mounted on a slide which travels along the arm. Graduations permit a direct reading of the distance between the mirrors.

Emergency fuel from the farm woodland. A. F. HAWES (*U. S. Dept. Agr., Office Sec. Circ.* 79 (1917), pp. 8).—This circular discusses the necessity of supplementing the coal supply with wood, the relative heating value of wood and coal, methods of making cordwood, wood as a profitable farm crop, opportunity to improve the woodland, and community action regarding wood supply.

The substitution of other materials for wood.—*Studies of the lumber industry*, XI, R. THELEN (*U. S. Dept. Agr. Rpt.* 117 (1917), pp. 78, figs. 28).—This report, which was prepared under the direction of the Forest Service, comprises a compilation of all the data obtainable, even if not wholly complete or exact, on the replacement of lumber and wood in other forms. The report covers substitution in thirty or more forms of use, and conclusions and suggestions relative to substitution are presented.

Tanning materials from native sources in Latin-American countries. T. H. NORTON (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 8, pp. 130-153, pls. 2, fig. 1).—A paper presented at the Second Pan American Scientific Congress, held at Washington, D. C., December 27, 1915, to January 8, 1916, in which the author describes the occurrences of tannins in such woods, barks, leaves, excrescences, roots and bulbs, and fruits and seeds of the Latin-American flora as are actually or potentially of importance among the world's sources of tanning materials.

Dyestuffs from materials native to Latin-American countries. S. P. SADLER (*Proc. 2. Pan Amer. Sci. Cong.*, 1915-16, vol. 8, pp. 153-162).—In this paper, read before the Second Pan American Scientific Congress, held at Washington, D. C., December 27, 1915, to January 8, 1916, the author briefly discusses the extraction of dyes from vegetable and animal sources, such as dyewoods and certain color-yielding insects, as compared with the manufacture of the synthetic or coal-tar dyes. The important dyewoods and dye-yielding plants of Latin-American countries are enumerated.

Seasoning of wood. J. B. WAGNER (*New York: D. Van Nostrand Co.*, 1917, pp. XIII+274, pl. 1, figs. 100).—A treatise on the natural and artificial processes employed in the preparation of lumber for manufacture, with detailed explanations of its uses, characteristics, and properties.

The preservation of shingles. (*Pennsylvania Sta. Bul.* 147 (1917), p. 38).—No difference was observed in the lasting qualities of redwood, red cedar, and chestnut shingles and creosoted shingles of chestnut, southern yellow pine, and pitch pine after being laid nine years. Creosote treatment cost about 50 cts. per bundle.

Chestnut fence posts creosoted and set were found in good condition after ten years, while check posts were badly rotted.

Zinc chlorid as a preservative of structural timber. O. M. SPOFFORD (*Trans. Nat. Assoc. Cotton Manfrs.*, No. 102 (1917), pp. 236-241).—In this paper the author presents the results secured in a series of tests conducted during the last three years in the laboratories of the Massachusetts Institute of Technology, to determine the effect of the zinc chlorid or Burnettizing process of

preservation upon the strength of timber under varying conditions of time, temperature, and humidity. The tests are to be continued.

Practical wood preservation processes for prolonging the life of mill roofs, C. H. TRESDALE (*Trans. Nat. Assoc. Cotton Manfrs.*, No. 102 (1917), pp. 231-235).—A short paper on this subject presented at the annual meeting of the National Association of Cotton Manufacturers at Boston, April 25 and 26, 1917.

DISEASES OF PLANTS.

Department of botany, A. V. OSMUN (*Massachusetts Sta. Rpt. 1916*, pp. 59-64).—A brief account is given of the various lines of investigation carried on by the department of botany, including studies of an anthracnose of shade trees due to *Glucosporium* sp. which is believed to be responsible for the disease on a number of different species of trees, spindling sprout of potatoes, an unusual rotting of potatoes due to *Phytophthora infestans* which was not accompanied by blighting of the vines, the overwintering of the white pine blister rust fungus on *Ribes*, injury to white pines apparently due to weather conditions, and outbreaks of downy mildew on greenhouse cucumbers; experiments which gave negative results with the potato powdery scab in Massachusetts; and tobacco and onion disease investigations.

The production of spores by *Alternaria solani* in pure culture. R. D. RANDS (*Phytopathology*, 7 (1917), No. 4, pp. 316, 317, fig. 1).—The author reports having been able to secure spore production by *A. solani* in pure cultures. The fungus was grown on hard potato agar for several days, then shredded and stirred, and the moisture relations controlled for 24 to 48 hours thereafter.

***Puccinia subnitens* and its æcial hosts,** E. BETHIEL (*Phytopathology*, 7 (1917), No. 2, pp. 92-94).—As a result of culture experiments, the author reports *P. subnitens*, the common rust of *Distichlis spicata*, as producing æcia on 22 species of plants embraced in 15 genera and 6 families.

Note on *Xylaria polymorpha* and *X. digitata*, J. R. WEIR (*Phytopathology*, 7 (1917), No. 3, pp. 223, 224).—The author reports having observed in 1906, near Scottsburg, Ind., *X. polymorpha* in diseased areas in living roots of a 4-year-old apple tree. In the same orchard in 1908, *X. digitata* was collected from the roots of a 6-year-old pear tree. In addition, the author reports collecting *X. digitata* from roots of *Populus trichocarpa* and *Crataegus douglasii* at Priest River, Idaho.

Grain smuts, D. B. SWINGLE (*Montana Sta. Circ. 70* (1917), pp. 4).—Descriptions are given of oat and wheat smuts and treatments recommended for their control, as well as for smuts of other cereals.

Notes on the distribution of the bacterial disease of western wheat grass, P. J. O'GARA (*Phytopathology*, 7 (1917), No. 3, pp. 225, 226).—The disease of western wheat grass due to *Aplanobacter agropyri*, formerly reported in two counties in Utah (E. S. R., 36, p. 647), is recorded as occurring in three widely separated districts of Montana.

A bean disease introduced in diseased seeds, H. GARMAN (*Kentucky Sta. Circ. 16* (1917), pp. 91-95, fig. 1).—A description is given of bean anthracnose, with suggestions for its control.

Factors affecting the parasitism of *Ustilago zeæ*, F. J. PIEMEISEL (*Phytopathology*, 7 (1917), No. 4, pp. 294-307).—The author reports a study of corn smut (*U. zeæ*) made to determine the vitality of the spores and sporidia, the effect upon them of placing corn in the silo, etc.

The infection of corn by *U. zeæ* is said to be purely local, no evidence having been found of systematic infection. When very young plants are attacked, they may be killed. Injury to the host plant, close planting, very early or

very late planting, and growth on very rich soil are conducive to attack, and vigorously growing plants between 2 and 3 ft. high are most susceptible.

The spores of *U. zeæ* can cause infection when either young or old. They germinate readily as soon as mature and retain their viability for several years. The spores, almost without exception, lost their viability after having been kept in a silo for a few weeks, a result brought about, it is thought, by the acids formed by the silage.

Drying and freezing temperatures were found to injure the sporidia very little. Alternate freezing and thawing, however, were injurious to moist sporidia, less so to desiccated sporidia. The optimum temperature for the budding of the sporidia was found to be between 20 and 26° C., the maximum at about 40°, and the thermal death point near 46°. The ability of sporidia, as well as of spores, to withstand unfavorable conditions is considered very significant in explaining some of the facts in the parasitism of *U. zeæ*.

The occurrence of *Colletotrichum solanecolum* on eggplant, P. J. O'GARA (*Phytopathology*, 7 (1917), No. 3, pp. 226, 227, fig. 1).—The author reports an attack by *C. solanecolum* on eggplants growing in a field which had produced potatoes the previous year.

Sclerotium bataticola, the cause of a fruit rot of peppers, W. H. MARTIN (*Phytopathology*, 7 (1917), No. 4, pp. 308-312, figs. 10; *abs. in ditto*, 7 (1917), No. 1, p. 64).—A disease of peppers is described which is characterized by the presence of numerous minute black sclerotia throughout the fruit as well as on the seed. A fungus which is identical with *S. bataticola* has been isolated from diseased material and grown in pure cultures. Successful cross inoculations have been made on peppers and sweet potatoes, as well as on cucumber, tomato, apple, and eggplant.

The pathogenic action of *Rhizoctonia* on potato, H. T. GÜSSOW (*Phytopathology*, 7 (1917), No. 3, pp. 209-213, fig. 1).—According to the author, there is no satisfactory evidence demonstrating the pathogenic action of *Rhizoctonia* on its various host plants, particularly the potato. He has made a study of the subject from which he concludes that the destruction caused is largely due to injury to the feeding roots, and that the loss of the feeding roots in potato plants accounts for all the symptoms associated with this disease. This hypothesis is also believed to offer an explanation of the soil contamination and the persistence of the organism in land once infected.

Potato diseases in Indiana, H. S. JACKSON and G. A. OSNER (*Indiana Sta. Circ.* 71 (1917), pp. 16, figs. 5).—The authors describe the more common potato diseases known to occur in Indiana and offer suggestions for their control.

Bacillus morulans n. sp., a bacterial organism found associated with curly top of the sugar beet, P. A. BONCQUET (*Phytopathology*, 7 (1917), No. 4, pp. 269-289, figs. 7).—In a previous publication (*E. S. R.*, 34, p. 645), the occurrence of a bacterial organism in connection with the curly top disease of sugar beets was reported. In the present paper the author describes *B. morulans* n. sp. as the cause of the disease, and gives an account of his bacteriological investigations and the results of isolation experiments with the organism.

Lightning injury to sugar cane, J. A. STEVENSON (*Phytopathology*, 7 (1917), No. 4, pp. 317, 318, fig. 1).—A description is given of the destruction by lightning of a small area of sugar cane in one of the fields of the Insular Experiment Station at Rio Piedras, P. R.

Studies on *Bacterium solanacearum*, E. E. STANFORD and F. A. WOLF (*Phytopathology*, 7 (1917), No. 3, pp. 155-165, fig. 1).—Data are presented regarding the distribution within North Carolina of the disease of tobacco and tomato due to *B. solanacearum*, on cultural studies to determine the identity of the strains from the several hosts, and on the results of cross inoculations. The

wilt of tobacco has been observed in 11 counties of North Carolina and the tomato wilt caused by the same organism in 39 counties of the State. Cultural studies on the identity of the organism from various host plants showed that there was no greater variation in the strains from the different hosts than in strains all of which came from the same host.

As a result of cultural studies, the authors have added 13 species of plants to the known hosts of *B. solanacearum*, and it is claimed that 9 families are now known to be subject to attack. Attention is called to the economic bearing of weed and cultivated host plants in problems of control.

Buckeye rot of tomato fruit, C. D. SHERBAKOFF (*Phytopathology*, 7 (1917), No. 2, pp. 119-129, figs. 5).—A detailed account is given of a rot of tomato fruit in Florida locally known as buckeye rot, of which a preliminary report has been noted (E. S. R., 37, p. 651). The rot is said to be caused by *Phytophthora terrestris* n. sp., a technical description of which is given.

This disease occurs only on fruit that touches or nearly touches the ground, but may cause considerable injury to fruit in the field and in transit. Staking the plants in the field to remove the fruit as far as possible from the ground and holding the fruit for a few days before packing are methods of control suggested.

Phytophthora infestans, causing damping-off of tomatoes, J. E. HOWITT (*Phytopathology*, 7 (1917), No. 4, p. 319).—Attention is called to the damping-off of tomatoes due to *P. infestans*, at least 50 per cent of the plants from large nursery shipments to certain sections of Ontario having been destroyed in 1916.

Apple scab on the twigs, M. T. COOK and C. A. SCHWARZE (*Phytopathology*, 7 (1917), No. 3, pp. 221, 222).—The authors report the occurrence on apple twigs of *Venturia pomi* in the spring of 1916, viable conidia having been present in considerable abundance. The presence of the organism on the twigs is believed to have an important bearing on the infection of apples during the growing season.

Blister spot of apples and its relation to a disease of apple bark, D. H. ROSE (*Phytopathology*, 7 (1917), No. 3, pp. 198-208, figs. 3).—A disease of apple is described in which small blister-like spots are formed in the fruit of a number of varieties. The trouble is said to be due to *Pseudomonas papulans* n. sp.

As a result of inoculation experiments, the author has shown that this species of bacteria can also produce two forms of disease on the twigs and branches known as rough bark or scurfy bark canker. A preliminary comparative study of the culture characteristics of the organisms taken from the fruit and the bark suggests that the differences between them are of degree rather than of kind and that all three diseases are probably caused by one species of organism.

Apple diseases in Indiana, with spray schedule, H. S. JACKSON (*Indiana Sta. Circ.* 70 (1917), pp. 23, figs. 14).—A popular description is given of a number of the more common diseases to which the apple is subject, and a spray schedule is appended for the prevention of fungus and insect attacks.

A new leaf spot disease of cherries, B. A. RUDOLPH (*Phytopathology*, 7 (1917), No. 3, pp. 188-197, figs. 3).—A leaf spot of sweet cherries first observed by the author in 1913 has been investigated at some length and determined to be due to a fungus of close relationship to *Alternaria citri*, which is technically described as *A. citri cerasi* n. var.

Conspicuous spots are formed upon the leaves of cherry, the fungus usually gaining entrance to the leaf tissue through injuries made by insects. Inoculations on the bark and wood of normal cherry twigs gave negative results, but from inoculations upon cherry leaves characteristic spots were obtained, as also from inoculations on the leaves of a considerable number of other plants, embracing apple, box elder, prune, plum, avocado, watermelon, and peach.

The organism is considered a wound parasite only, and it can be distinguished from *A. citri* with difficulty.

The perfect stage of *Gloeosporium venetum*, W. H. BUCKHOLZER (*Phytopathology*, 7 (1917), No. 2, pp. 83-91, figs. 3).—The author reports having observed a peculiar ascomycete while studying the anthracnose of the raspberry due to *G. venetum*. As the fungus was only found in connection with anthracnose lesions, further studies, made to determine whether there was any relation between the two forms, led him to conclude that the second fungus observed is the perfect stage of *G. venetum* and that it belongs to the genus *Plectodiscella*. The name of the fungus, based on the fact that it is the perfect stage of *G. venetum*, would be *P. veneta* n. sp. A technical description is given of the organism.

Some changes produced in strawberry fruits by *Rhizopus nigricans*, N. E. STEVENS and L. A. HAWKINS (*Phytopathology*, 7 (1917), No. 3, pp. 178-184).—The results are given of an investigation of the biochemical changes brought about in strawberry fruits by *R. nigricans*.

The effect of the fungus upon the various constituents of the strawberry is said to be much the same as that produced by other fungi on their host plants. The authors account for the loss of juice which occurs in strawberries attacked by *R. nigricans* as probably due to the fact that the fungus so affects the protoplasm of the cells that it is no longer capable of functioning as a semipermeable membrane.

End rot of cranberries, C. L. SHEAR (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 2, pp. 35-42, pl. 1, figs. 3).—The author describes an end rot disease of cranberry due to *Fusicoccum putrefaciens* n. sp., which is said to have been found in all the cranberry-growing sections of the United States and which has occasioned considerable loss in the past few years, especially to the Lat-Howe variety. The rot is reported to start at either the blossom or the stem end of the berry, finally producing a soft rot of the fruit.

From circumstantial evidence, the author believes that the fungus, which is technically described, is genetically related to a species of *Cenangium*.

Spraying experiments in Massachusetts have shown that the disease may be largely prevented by the use of Bordeaux mixture. Some injury to cranberry vines has been observed associated with the application of Bordeaux mixture on the experimental plats in Massachusetts, but not elsewhere. The cause of the injury is being investigated.

A Rhizoctonia of the fig, J. MATZ (*Phytopathology*, 7 (1917), No. 2, pp. 110-118, pl. 1, figs. 3).—A technical description is given of *R. microsclerotia* n. sp. the cause of a disease of fig in Florida. An account of the relation of the fungus to the leaf blight of fig has been noted (*E. S. R.*, 37, p. 652).

Variations in *Colletotrichum gloeosporioides*, O. F. BURGER (*Abstr. in Phytopathology*, 7 (1917), No. 2, p. 151).—From a study of cultures of *C. gloeosporioides* isolated from different species of Citrus in California the author has grouped the strains into three classes, based on the mycelial characters as developed in artificial media.

Species of *Melampsora* occurring upon *Euphorbia* in North America, E. B. MAINS (*Phytopathology*, 7 (1917), No. 2, pp. 101-105).—Technical descriptions are given of *M. euphorbiae-gerardinae*, *M. euphorbiae*, and *M. monticola*, the last being a new species. All of these species are said to occur on *Euphorbia* in North America, but none of them had been reported in this country until within the past year.

Diseases of ornamental plants, D. C. BARCOCK (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 10, pp. 323-328, figs. 4).—A description is given of some of the more com-

diseases of a number of ornamental plants, with suggestions for their control.

Recent cultures of forest tree rusts, J. R. WEIR and E. E. HUBERT (*Phytopathology*, 7 (1917), No. 2, pp. 106-109).—Reports are given of inoculation experiments with a number of heteroecious rusts in which the host relationships of *Cronartium coleosporoides*, *C. comptoniae*, *Mcclamsora medusae*, *M. bigelovicii*, *Pucciniastrum pustulatum*, *Gymnosporangium tubulatum*, and *G. nelsoni* were established.

Pycnial stages of important forest tree rusts, J. R. WEIR and E. E. HUBERT (*Phytopathology*, 7 (1917), No. 2, pp. 135-139, figs. 2).—The discovery of abundant exudations of pycnosporos on *Pinus ponderosa* and *P. contorta* caused by *Cronartium comandrae* led the authors to make a study of the pycnial stages of *C. coleosporoides*, *C. comptoniae*, and *C. cerebrum*. The pycnial stages of these fungi were found and technical descriptions are given of these forms.

In connection with these investigations, a species of *Tubercullina* was found attacking the pycnial and aelial stages of the different species of *Cronartium* on pines. The occurrence of the *Tubercullina* is said not to have been sufficiently abundant to indicate its economic importance.

Notes on *Bazoumofskyia campylopoda*, G. G. HEDGECOCK and N. R. HUNT (*Phytopathology*, 7 (1917), No. 4, pp. 315, 316).—As a result of inoculation experiments in which seeds of *R. campylopoda* from *Pinus sabiniana* were transferred to 18 species of *Pinus* and also to *Larix occidentalis* and *Pseudotsuga taxifolia*, the authors were able to establish the dwarf mistletoe on *Pinus banksiana*, *P. bungeana*, *P. caribaea*, *P. pinea*, *P. sabiniana*, and *P. virginiana*. On *P. bungeana* and *P. virginiana*, dense witches' brooms were found around the mistletoe-infected regions. On the other species, spindle-shaped swellings were usually formed at the point of attack. All these species except *P. sabiniana* are said to be new hosts for this species of mistletoe in this country.

As the mistletoe is a western species which is able to attack vigorously a number of species of eastern pines, the authors call attention to the desirability of discouraging shipments of nursery stock from the Rocky Mountain and Pacific regions to those further east, because of the possibility of introducing the mistletoe to eastern plantations.

Witches' brooms on hickory trees, F. C. STEWART (*Phytopathology*, 7 (1917), No. 3, pp. 185-187, fig. 1).—A brief description is given of witches' brooms on the shell bark hickory (*Carya ovata*) caused by the fungus *Microstroma anglicum*.

A *Nectria* parasitic on Norway maple, M. T. COOK (*Phytopathology*, 7 (1917), No. 4, pp. 313, 314).—In a previous publication (E. S. R., 33, p. 249), the author called attention to an attack on Norway maple in 1913 by a species of *Nectria*. Later investigations have shown that the disease, although present a subsequent years, was much less severe than in 1913. Besides the Norway maple, the author has found the fungus attacking mulberry, on which it is apparently a weak parasite.

Sparassis radicata, an undescribed fungus on the roots of conifers, J. R. WEIR (*Phytopathology*, 7 (1917), No. 3, pp. 166-177, figs. 5).—A description is given of *S. radicata* n. sp., which is said to be widely distributed in the Northwest and often to attack the roots of *Pseudotsuga taxifolia*, *Picea engelmanni*, *Pinus monticola*, and *Larix occidentalis*. The mycelium of the fungus is said to attack the base of the roots and later the wood, producing a yellow or brown rotting rot.

Needle rust on *Pinus resinosa*, P. SPAULDING (*Phytopathology*, 7 (1917), No. 3, p. 225).—The author reports the occurrence in 1916 near Sharon, Vt., of

Coleosporium solidaginis and *C. delicatulum* on a plantation of about 10,000 trees of *P. resinosa*.

Contributions to our knowledge of the white pine blister rust, W. A. McCUBBIN (*Phytopathology*, 7 (1917), No. 2, pp. 95-100, fig. 1).—An attempt has been made by the author to determine the method of infection of the pine by *Cronartium ribicola*. A large number of infections were examined, from which it appeared that the chief mode of infection was by way of the leaf fascicles through the so-called short shoots.

Studies were made of the life cycle of the fungus on the pine, from which the author concludes that it has a 5-year cycle. The first season is a period of infection, followed by a dormant period during the second season, with swelling of the host tissues in the third and fourth seasons, and the formation of sphaeria in the fifth and following seasons. This outline of the life cycle is believed to obtain in the majority of cases, although it is not entirely invariable.

Early discovery of white pine blister rust in the United States, R. G. PIERCE (*Phytopathology*, 7 (1917), No. 3, pp. 224, 225).—A brief note is given on the determination in 1905 by Mrs. F. W. Patterson, mycologist of the U. S. Department of Agriculture, of *Peridermium* on white pine. This record antedates previous reports on this fungus.

State and national quarantines against the white pine blister rust, P. SPAULDING and R. G. PIERCE (*Phytopathology*, 7 (1917), No. 4, pp. 319-321).—From a tabulated statement showing the quarantines that have been declared against the transportation of white pines as a prevention of the spread of the white pine blister rust, it is seen that 18 States, the United States, and Canada prohibit the movement of all white pines or the 5-leaved species, and in a number of instances the interstate movement of currants and gooseberries is also prohibited.

Synthetic culture media for wood-destroying fungi, E. J. PIEPER, C. J. HUMPHREY, and S. F. ACREE (*Phytopathology*, 7 (1917), No. 3, pp. 214-220).—Formulas are given for synthetic culture media for wood-destroying fungi such as *Fomes*, *Lenzites*, *Stereum*, etc.

The mononchs (*Mononchus* Bastian 1866), a genus of free-living predatory nematodes, N. A. COBB (*Soil Sci.*, 3 (1917), No. 5, pp. 431-486, figs. 75).—In a brief introduction the author states that a careful examination has fully demonstrated the predacious character of certain common and widely spread soil-inhabiting species, which are found to feed on other small animal organisms, such as protozoa and rotifers, and other nematodes, and has led to the determination that practically all mononchs are predacious. The evidence indicates that the nematodes destroyed are injurious to agriculture since all 14 species observed have proved to be carnivorous. Mononchs were formerly considered as harmful to vegetation, due (1) to the congregating about the roots and between the leaf sheaths of plants, especially succulent plants, and (2) to the fact that vegetable matter was often found in their intestines.

The first part of this work (pp. 433-453) is devoted to the structure, functions, and distribution of mononchs, which constitute a genus of free-living predatory nematodes inhabiting soil and fresh water, as well as the above-ground parts of certain plants. The second part (pp. 453-486) is devoted to a classification of the genus, including a table for the separation and descriptions of 60 species belonging to 6 subgenera, of which 31 are described as new. They appear to molt four times.

A bibliography of 50 titles is included.

Segmentation in nematodes: Observations bearing on the unsettled question of the relationship of nematodes to other branches of the animal kingdom, N. A. COBB (*Science*, n. ser., 45 (1917), No. 1171, p. 593, figs. 2).

The cuprammonium washes, their preparation, biological properties, and application, O. BURLIN (*New Hampshire Sta. Sci. Contrib.* 10 (1917), pp. 235-263, pls. 8; *Phytopathology*, 7 (1917), No. 4, pp. 235-263, pls. 8).—The results are given of a study of the composition and preparation of the different cuprammonium washes, their relative toxicity and the conditions affecting the same, and the relative efficiency and effectiveness of these washes used as fungicides. The cuprammoniums met with in practice are cuprammonium sulphate, which is a very unstable product, and cuprammonium hydrate and cuprammonium carbonate, both of which are quite stable.

The author concludes that the cuprammoniums are more toxic when slowly than when quickly dried, their toxicity being due to soluble copper. When large amounts of soluble copper are required to give protection, the cuprammonium washes are preferable to Bordeaux mixture; but when small amounts of soluble copper are sufficient, the cuprammonium washes are said to be less effective than Bordeaux mixture so far as withstanding weathering and yielding soluble copper for protection against organisms are concerned, although the cuprammonium washes are more efficient with regard to the solubility of their copper and its toxicity in solution. The relative efficiency of the unit copper in the cuprammoniums in decreasing order is said to be as follows: Copper sulphate ammoniac, malachite ammoniac, copper sulphate ammonium carbonate, and malachite ammonium carbonate.

The cuprammoniums may be used at 11.7 times their lethal concentration for *Plasmopara viticola* on plants not affected by 0.0075 per cent of soluble copper. They are considered of limited practical applicability and should not be used in lieu of Bordeaux mixture whenever the latter yields sufficient soluble copper to give protection.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Life zone investigations in Wyoming, M. CARY (*U. S. Dept. Agr., Bur. Biol. Survey, North American Fauna* No. 42 (1917), pp. 95, pls. 15, figs. 17).—This report is based upon the results of natural history explorations conducted in recent years by field parties of the Bureau of Biological Survey in all the important physiographic areas of Wyoming. The first section characterizes the five transcontinental life zones represented in the State, defines their extent and limits, and discusses their economic possibilities. The second section consists of notes on the distribution and abundance of conspicuous trees and shrubs observed during the progress of the survey. An accompanying map shows in detail the extent and boundaries of the life zones which traverse the State.

The rat pest, E. W. NELSON (*Nat. Geogr. Mag.*, 32 (1917), No. 1, pp. 1-23, figs. 29).—Attention is called to the economic importance of the rat.

A distributional list of the land birds of west central Oregon, A. C. SHELTON (*Univ. Oreg. Bul.*, n. ser., 14 (1917), No. 4, pp. 51, figs. 11).—This paper, which consists of an annotated list of 143 forms, includes a discussion and an illustrated outline of the life zones of west central Oregon.

Birdcraft, MABEL O. WRIGHT (*New York and London: The Macmillan Co.*, 1917, 9. ed., pp. XXIII+317, pls. 80).—The main part of this work consists of synopses of bird families (pp. 43-54) and bird biographies (pp. 55-279). Keys to the land birds, birds of prey, and game, shore, and water birds are appended.

Your bird friends and how to win them, J. H. DOBSON (*Kankakee, Ill.: Author*, [1917], pp. 24, figs. 46).—Methods of attracting, housing, etc., of wild birds are described.

Bird houses (Philadelphia: [Curtis Pub. Co., 1917], pp. 18, figs. 120).—Illustrated plans are given for 60 devices for supplying shelter and food for birds.

Bibliography of Canadian zoology, E. M. WALKER (Proc. and Trans. Roy. Soc. Canada, 3. ser., 10 (1917), Sect. IV, pp. 291-215).—One hundred and eighty titles are listed.

Bibliography of Canadian entomology for the year 1915, C. J. S. BETHUNE (Proc. and Trans. Roy. Soc. Canada, 3. ser., 10 (1917), Sect. IV, pp. 169-187).—One hundred and seventy-five titles are listed.

Index to the literature of American economic entomology, January 1, 1905, to December 31, 1914, compiled by N. BANKS (Melrose Highlands, Mass.: Amer. Assoc. Econ. Ent., 1917, pp. V+323).—In this index the literature of each subject is arranged alphabetically by authors.

Studies in insect life and other essays, A. E. SHIPLEY (London: T. Fisher Unwin, Ltd., 1917, pp. XI+338, figs. 11).—Papers on Insects and War; The Honeybee; Bombus, the Humblebee; On Certain Differences Between Wasps and Bees; and Grouse Disease are included.

The biological sciences applied to agriculture in the control of insect pests and plant diseases in the United States, P. MARCHAL (Min. Agr. [France], Ann. Serv. Épiphyties, 3 (1914), pp. 31-382, figs. 156; rev. in Science, n. ser., 45 (1917), No. 1169, pp. 503, 504).—This is a report upon an inspection trip made by the author during 1913 in which he deals with the work of several of the bureaus of the U. S. Department of Agriculture, particularly the Bureau of Entomology (pp. 52-199), the experiment stations, etc.

Nineteenth annual report of the State entomologist for 1916, E. L. WASHBURN (Ga. Bd. Ent. Bul. 48 (1917), pp. 36, pl. 1).—This report of the work of the year deals particularly with the boll weevil, which, by November, 1916, had appeared in 116 counties in the State. Among other insects, work with which is reported, are several pecan pests, including the pecan case bearer (*Aerobasis nebulella*), which is responsible for more injury to the pecan than any other insect; the nut case bearer (*A. hebecella*), which destroyed 50 per cent of the crop in one grove but is still confined to the vicinity of Thomasville and Cairo; the shuck worm (*Euharmonia caryana*), which is probably the most widespread of the species attacking pecans, occurring throughout the State; aphids (*Monellia costalis* and *Monellia* sp.); and the fall webworm.

[Report of the Department of entomology, H. T. FERNALD (Massachusetts Sta. Rpt. 1916, pp. 78a, 79a).—This is a brief statement of the occurrence of the more important insects and of the work of the year.

Observations of the strawberry crown girdler in a forest nursery, a serious outbreak of which was recorded the previous year (E. S. R., 36, p. 156), indicated that the period of extensive destruction at that place was drawing to an end and that the methods of treatment then recommended were to a large degree successful in checking further injury.

Work connected with insect and fungus pests and their control (Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Antigua, 1915-16, pp. 15-17).—Observations during the year indicate that the scoliid parasite *Tiphia parallela* of white grubs has become established in Antigua. Brief mention is made of insects attacking cotton, yams, limes, onions, etc.

Report on insect pests in Finland for 1913, W. M. LINNANIEMI (Landt. Styr. Meddel. [Finland], No. 99 (1915), pp. 68, pl. 1, figs. 23).—This report upon the occurrence of and work with the more important insect pests in Finland during 1913.

Work of the Kief station in the control of insect pests in 1914. V. V. DOKHOVANSKIĬ (Otchet Radotakh Ent. Otd. Kiev. Sta. Borbo Vred. Rast., 1914, pp. 41, figs. 5).—A summary of work carried on at the Kief station, especially

with the Swedish or frit fly (*Oscinella frit*), the winter cereal fly (*Leptohylemyia coarctata*), insecticides, etc. Examinations made of the stomach contents of moles are also reported upon.

Report of the imperial entomologist, T. B. FLETCHER (*Rpt. Agr. Research Inst. and Col. Pusa, 1915-16, pp. 58-77; abs. in Rev. Appl. Ent., Ser. A, 5 (1917), No. 3, pp. 124-126*).—This reports upon the occurrence of and work of the year with insect pests in India.

Economic zoology (*Ann. Rpt. Bd. Sci. Advice India, 1915-16, pp. 152-176*).—Under the heading of agricultural entomology (pp. 152-173), T. B. Fletcher deals with the occurrence of and work with insect pests in Pusa, the Provinces, and native States, including a list of publications on entomology. Forest entomology is dealt with by N. C. Chatterjee (pp. 173-176).

Pests and diseases of New Zealand flax, D. MILLER (*Jour. Agr. [New Zeal.], 14 (1917), No. 6, pp. 431-439, figs. 2*).—This is a progress report of studies of the life history and methods of control of *Xanthorhoe perfectata*, the larvæ of which damage the leaf and fiber of New Zealand flax (*Phormium tenax*), and of other insects which incidentally were found to do considerable damage to flax. Those reported upon are *Melanchna steropastis*, the larvæ of which cut notches from the edge of the leaf and are most abundant upon the hill flax; *Phyticus omnivorus*, the larvæ of which remove the lower epidermis of the flax leaf in circular patches; etc.

Paddy pests in Travancore (*Trop. Agr. [Ceylon], 48 (1917), No. 6, p. 362*).—The rice bug (*Leptocoris varicornis*) was the most important pest during 1915-16. The rice swarming caterpillar (*Spodoptera mauritia*) appeared in some parts of Kuttanad, and the rice stem borer (*Scenobius bipunctifer*) is a common rice pest all over the State.

Insects and diseases of orchards and garden and their control, G. S. RALSTON and R. E. MARSHALL (*Va. Polytech. Inst. Ext. Bul. 14, (1917), pp. 55*).—A popular summary of information.

Common garden insects and their control, A. GIBSON (*Canada Dept. Agr., Ent. Branch Circ. 9 (1917), pp. 20, fig. 1*).—A popular summary of information.

Spraying for apple aphids and red bugs in New York, H. E. HONGKISS (*Proc. Fruit Growers Assoc. Adams Co., Penn., 11 (1915), pp. 83-93*).—An address consisting of a summary of information on the control of these pests.

Defoliation, a defensive measure against vine pests, J. CAPUS (*Bul. Soc. Etude et Vulg. Zool. Agr., 15 (1916), No. 11-12, pp. 118-122; abs. in Rev. Appl. Ent., Ser. A, 5 (1917), No. 3, p. 137*).—Experience has shown that defense against *Cochylis ambiguella* and *Eudemis botrana* is impossible without preliminary defoliation, and that this must be done at the time when the inflorescences are formed and before the leaves removed are full grown. A second defoliation is recommended if the fruit again becomes hidden by the development of the leaves; this gradual exposure prevents the grapes from being dried up by the sun.

Shade and forest insects in Manitoba, J. M. SWAINE (*Agr. Gaz. Canada, 4 (1917), No. 9, pp. 755-763*).—Brief mention is here made of the western willow leaf beetle (*Galerucella decora*), the fall cankerworm, the spring cankerworm, the Negundo plant louse (*Chaitophorus negundinis*), the Negundo twig borer (*Protepteryx willingana*), the spruce sawfly (*Lophyrus abietis*), the larch sawfly, etc.

Insects and prickly pear, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 28 (1917), No. 6, pp. 417-426, figs. 4*).—In considering the relation of insects to the prickly pear, the author has made extracts from Tryon and Johnston's report, previously cited (E. S. R., 33, p. 134), and he comments on some of the suggestions of the

commissioners regarding insects that might be introduced from abroad into Australia to destroy the prickly pear.

Household pests and their treatment, H. GARMAN (*Kentucky Sta. Circ.* 13 (1917), pp. 63-90, figs. 14).—This is a popular summary of information.

The parasite methods of controlling insect pests, H. S. SMITH (*Cal. Citrogr.* 2 (1917), No. 6, pp. 2, 3, figs. 4).—This popular review of the subject includes an introduction by G. H. Hecke, State commissioner of horticulture of California.

The double purpose spray, A. A. RAMSAY (*Agr. Gaz. N. S. Wales*, 28 (1917), No. 6, pp. 435-437).—A report upon the results obtained from adding lead arsenate to other spray mixtures. The experiments indicate that soap should not be mixed with lead arsenate, but that lead arsenate may be mixed with both Bordeaux mixture and lime-sulphur mixture with safety.

Fumigation of ornamental greenhouse plants with hydrocyanic acid gas, E. R. SANSNER and A. D. BORDEN (*U. S. Dept. Agr., Farmers' Bul.* 880 (1917), pp. 19, figs. 4).—Substantially noted from another source (*E. S. R.*, 36, p. 842).

Detection of hydrocyanic acid gas.—Use of small animals for this purpose, S. B. GRUBBS (*Pub. Health Rpts. [U. S.]*, 32 (1917), No. 16, pp. 565-570, fig. 1).—The author's experiments, here summarized in tabular form, have led to the following conclusions:

"Sparrows or other small birds are the most delicate live indicators for hydrocyanic acid gas, but are not recommended for routine work. Mice or tame rats are almost as susceptible as sparrows and are probably the best test animals available. Cats are sufficiently susceptible, and with care the same animal may be used several times. Guinea pigs are quite resistant to the effects of the gas and should never be used where rats are available. If guinea pigs be the only test animals obtainable, exposure should be prolonged and other allowances made for these animals' increased resistance to the gas, as indicated in the included table."

Directions for raising rats and mice, by W. E. Castle and L. C. Dunn, are appended.

The Blattidae of North America, north of the Mexican boundary, M. HERBARD (*Mem. Amer. Ent. Soc.*, No. 2 (1917), pp. 284+VI, pls. 10, figs. 2).—The author recognizes 43 established species and one geographic race of cockroaches belonging to 26 genera, of which 9 species and 4 genera are described as new. In a supplement he lists 31 species found to be adventive but not established in portions of the United States and Canada.

Destruction of the migratory locust, P. CARIDE MASSINI (*An. Soc. Rural Argentina*, 51 (1917), No. 4, pp. 309-314, pl. 1).—This paper deals at length with the sarcophagid parasite *Sarcophaga caridei*, an important enemy of the locust in South America, noted by Dawe (*E. S. R.*, 37, p. 357). A colored plate of the adult fly is included.

Fighting grasshoppers, including the results of a campaign conducted in 1916 and suggestions for the control of this pest, C. R. JONES (*Colo. Agr. Col. Ext. Serv. Bul.*, 1, ser., No. 118 (1917), pp. 12).—Substantially noted from another source (*E. S. R.*, 37, p. 661).

Is *Diastrammena marmorata* an injurious insect? M. WOLFF (*Centbl. Biol. [etc.]*, 2, Abt., 45 (1916), No. 6-12, pp. 258-262; *abs. in Rev. Appl. Ent.*, Ser. A, 5 (1917), No. 3, p. 98).—It is concluded that this orthopteran, introduced into Germany from Japan, does not feed on plants and that the injury ascribed to it is due to other less conspicuous insects.

Thrips attacking French bean flowers (*Agr. Gaz. N. S. Wales*, 28 (1917), No. 6, p. 426).—Through feeding upon the pollen, thrips injured French bean

flowers at Wamboral sufficient to prevent the formation of pods. Tobacco and soap applied as a spray appears to be a satisfactory remedy.

Work of combating the pear thrips in the Saanich Peninsula, A. E. CAMERON and R. C. TREHEARN (*Agr. Jour. (Brit. Columbia)*, 1 (1917), No. 12, pp. 208, 212).—The authors find that the attacks of pear thrips (*Taniothrips inconsequens*), which is distributed throughout the peninsula and as far north as Duncan, can be absolutely controlled on apples, although unsatisfactory results have been obtained in the control of the pest on Italian pears and prunes.

As a first application for apples, pears, cherries, prunes, and plums and later applications on cherries, prunes, and plums, whale-oil soap, 5 lbs.; blackleaf 40, $\frac{1}{2}$ pint; and water, 85 gals. is recommended, the first application to be made at the time the thrips make their appearance on the buds, the second when the blossoms are showing pink or white, as the case may be, and the third just after the blossoms are shed. Owing to the prevalence of apple scab the authors recommend a combination spray of summer strength lime-sulphur and blackleaf 40 in the proportion of 1:900 for the second and third applications for apples and pears.

"One of the most unsatisfactory aspects of the thrips attack in the Saanich Peninsula is the repeated failure of the prune crop. The buds are very soon destroyed once the pest effects an entrance, and the damage done to Italian prunes and different varieties of plum is probably far heavier proportionately than that done to pears."

Contribution to the knowledge of the galls of Java.—II. The thysanopterous cecidia of Java and their inhabitants, H. KARNY and W. and J. VAN LEEUWEN-REIJNVAAN (*Ztschr. Wiss. Insektenbiol.*, 10 (1914), Nos. 6-7, pp. 201-208; 8-9, pp. 288-296; 10-12, pp. 355-369; 11 (1915), Nos. 1-2, pp. 32-39; 3-4, pp. 85-90; 5-6, pp. 138-147; 7-8, pp. 203-210; 9-10, pp. 249-256; 11-12, pp. 324-331).—This second contribution to the thysanopterous cecidia and their inhabitants in Java is in continuation of that previously noted (*E. S. R.*, 30, p. 250).

Helopeltis in tea gardens, S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Proefstat. Thee*, No. 46 (1916), pp. 21; *abs. in Rev. Appl. Ent.*, Ser. A, 5 (1917), No. 3, pp. 131, 132).—This interim report deals with investigations of species of *Helopeltis* in Java extending over a period of two years.

Contribution to the *Helopeltis* problem in tea culture, S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten*, No. 25 (1916), pp. VI+214, pls. 13).—This is an extended report of investigations conducted in Java. The classification and biology of the several Javanese species of *Helopeltis*, namely, *H. antonii*, *H. theivora*, *H. cuneatus*, and *H. cinchona*, are first dealt with, followed by a discussion of natural enemies, control measures, etc.

H. antonii is the principal enemy of tea in Java. *H. theivora*, the most dangerous enemy of tea in British India, does not cause much injury in Java, and in West Java has only been found in the lowlands. *H. cuneatus*, a species new for the fauna of Java, does not attack tea and has been found only on plants of the family Aracæ. *H. cinchona*, a second species new for the fauna, has lately been found to attack tea and possibly will grow more dangerous in the future.

A map is given which shows their distribution in West Java. A summary of the investigation is given in English and a bibliography of 27 titles is included.

Citrus white fly (*Aleyrodes citri*) on lemons and oranges in the Province of Mendoza, Argentina, R. SANZIN (*Enol. Argentina*, 1 (1915), No. 2, pp. 42, 43, *Aps.* 6; *abs.* in *Rev. Appl. Ent.*, Ser. A, 3 (1915), No. 11, pp. 694, 695).—The citrus white fly has spread so rapidly in the Province of Mendoza that it is now one of the worst pests of oranges and lemons; not a single tree seems to be free from its attacks, which cause withering of the leaves.

Life history of *Macrosiphum illinoensis*, the grapevine aphid, A. C. BAKER (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 3, pp. 83-91, pls. 2).—In the present paper the author reports upon more recent studies than those previously noted (*E. S. R.*, 33, p. 857; 37, p. 358), in the first of which the alternation in food plants was recorded, and gives an account of all the forms of the species. This aphid, originally described by Shimer, from Illinois, in 1866 under the name *Aphis illinoensis*, and later by Thomas as *Siphonophora viticola*, is now known to occur in the District of Columbia, Georgia, Indiana, Maryland, Missouri, Mississippi, North Carolina, New Jersey, New York, Oklahoma, Pennsylvania, Texas, and Virginia, and what appears to be the same species was taken on grape at Campinas, Brazil, in September, 1898. It occurs abundantly on wild grape (*Vitis* spp.) in the southern United States and often is quite destructive to cultivated varieties.

The eggs, which are laid upon the twigs of *Viburnum prunifolium*, usually being placed most thickly close around the buds, sometimes hatch during quite cold weather in the third week in March and continue hatching until the early part of April. The stem mothers on hatching out seek the buds and begin feeding, and, when the flowers begin to open, may crowd down into the flower clusters. They feed upon the stems of the individual blossoms, upon the twigs, and somewhat upon the leaves.

The spring migrants begin to appear in the second generation, although their number is not abundant until the third generation and their production then gradually decreases for several generations. The spring migrants fly to wild grapes and to grapes in the vineyards, the migration being at its height during the first week in May.

The summer wingless forms occur very abundantly throughout the summer. They reproduce very quickly during the early summer and seven generations have often reached maturity by July 1. Intermediates between the summer winged and summer wingless forms have been found upon grape. Winged forms are produced in every generation from the second onward, but fewer winged line generations occur than wingless line generations.

The fall migrants are produced upon the grapes during the early part of October and are found upon the viburnum depositing young oviparous females during the second week in that month. "The males are produced a little later than the fall migrants, but can be found flying at the same time and may be taken on the viburnums in company with the fall migrants. . . . The oviparous female is a small, dark reddish aphid produced during the early part of October on the viburnum. It feeds upon the twigs and may be found until frost kills all the insects. Each oviparous female lays three to six eggs close about the buds or occasionally scattered along the twigs."

Aphididae of California, [XII], E. O. ESSIG (*Univ. Cal. Pubs. Ent.*, 1 (1917), No. 7, pp. 301-346, figs. 30).—This paper consists of descriptions of five new species of plant lice from California and notes on other Aphididae, chiefly from the campus of the University of California, Berkeley, Cal. See also a previous note (*E. S. R.*, 35, p. 56).

Butterflies worth knowing, C. M. WEED (*Garden City, N. Y.: Doubleday, Page & Co.*, 1917, pp. XIII+286, pls. 48).—A popular account.

On a case of facultative parthenogenesis in the gipsy moth (*Lymantria dispar*), with a discussion of the relation of parthenogenesis to sex, R. GOLDSCHMIDT (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 32 (1917), No. 1, pp. 35-43).—This paper includes a list of 22 references to the literature on the subject.

The bollworm or corn earworm, F. C. BISHOPP (*U. S. Dept. Agr., Farmers' Bul.* 872 (1917), pp. 15, figs. 7).—This popular account replaces *Farmers' Bulletin* 200, previously noted (*E. S. R.*, 19, p. 53).

Controlling the peach borer, S. W. FUNK (*Pract. Farmer*, 113 (1917), No. 18, p. 316).—In Pennsylvania the author has practiced banking peach trees with from 6 to 8 in. of earth during the entire year, and in this way prevented the borers from getting into the roots where they are hard to reach. The mounds are removed by the use of a hoe during September, the gum removed, and the borers cut out by means of a sharp knife. The importance of making the cut as nearly perpendicular as possible in order to prevent mutilating the bark is pointed out.

The currant borer, *Sesia (Ægeria) tipuliformis*, H. M. NICHOLLS (*Agr. and Stock Dept. Tasmania, Bul.* 69 (1917), pp. 8, figs. 5).—The common currant borer (*S. Ægeria tipuliformis*) is said to be rather widely spread in the northern part of Tasmania.

The cassava hawk moth (*Dilophonota ello*), A. DA SILVEIRA (*Bol. Agr. [Sao Paulo]*, 17 ser., No. 9 (1916), pp. 710-724).—A summary of information on this pest in Brazil, including descriptions of its several stages. Accounts of this insect in British Guiana by Bodkin (*E. S. R.*, 28, p. 354) and in Cuba by Cardin (*E. S. R.*, 28, p. 854) have been previously noted.

On the life history of the apple fruit miner, *Argyresthia conjugella*, H. OKAMOTO (*Trans. Sapporo Nat. Hist. Soc.*, 6 (1917), No. 3, pp. 213-219).—This is a report of observations made at the Hokkaido Experiment Station at Sapporo, Japan.

It appears that the eggs of *A. conjugella* are for the most part laid upon the fruit, though a very few are deposited upon the leaves. Two moths observed deposited 25 and 29 eggs, respectively, the preoviposition period varying from two to four days and the incubation period in the orchard from seven to eight days. The larvæ which hatch out upon the apples soon seek a place to enter, from 70 to 80 per cent of the larvæ entering the apple on the sides and from 20 to 30 per cent on the stem or calyx, gummy exudations commonly occurring at the place of entrance. The tunnels are numerous and extend in all directions. The larvæ that hatch out upon the leaves commence to feed there.

The average time spent in the fruit was 50 days for 10 larvæ observed. When about full grown the larva makes a passageway out of the fruit, usually toward the side of the apple, then enters the soil and forms its cocoon. The larvæ which develop late in the season sometimes spin their cocoons on the inside of boxes or barrels. Pupation takes place early in the following spring.

The adults spend most of their time resting in the foliage of the apple and are rarely seen in the orchard. When disturbed they fly away so quickly that the eye is unable to follow them. The moths do not appear to be attracted by lights at night.

Viviparity in the Diptera and the larvæ of viviparous Diptera, D. KELLIN (*Arch. Zool. Expt. et Gén.*, 55 (1916), No. 9, pp. 393-415, figs. 8; *abs. in Jour. Roy. Micros. Soc.*, No. 2 (1917), pp. 213, 214).—The Diptera which are always viviparous are divided by the author into two groups: (1) Those in which the larvæ are not nourished in the uterus of the mother, where only the embryonic development proceeds, namely, some Tachinariæ, Dexiidae, all the Sarcophagidae, various Anthomyiidae (*Musca larvipara* and *Mesembrina meridiana*); and (2) those in which the larvæ pass all their time in the maternal uterus, some

being born as larvæ (*Glossina*) and others as pupæ (*Hippobosca*, *Melophagus*, and *Ornithomyia*).

The relation of mosquitoes and flies to the epidemiology of acute poliomyelitis, H. NOGUCHI and R. KUDO (*Jour. Expt. Med.*, 26 (1917), No. 1, pp. 49-57).—" *Culex pipiens* raised from the larval stage in water experimentally contaminated with an abundance of poliomyelitic virus were found to be incapable of causing the infection when allowed in large numbers to bite normal *Macacus* monkeys. *C. pipiens*, which were fed on infected poliomyelitic monkeys during different stages of the disease, were found to be incapable of transmitting the infection when allowed in large numbers to bite normal *Macacus* monkeys. A previous disturbance of the meninges by an injection of horse serum into the intrathecal space did not alter the result, which was negative.

"The offspring of the mosquitoes, which were either reared in the infected tanks or fed on infected monkeys, were found to be entirely harmless when allowed to feed in large numbers on a normal monkey. There was no hereditary transmission of the virus from one generation to another. No trace of the virus of poliomyelitis was demonstrable in the filtrate of an emulsion of adult flies and pupæ of the common house fly and bluebottle fly, which were reared in the laboratory on silces, emulsion, or filtrate of monkey brain containing the poliomyelitic virus. The intracerebral injection of the filtrate produced no poliomyelitic infection in the normal monkey."

Notes on fly control in military camps, H. B. KIRK (*Wellington, New Zeal. New Zealand Defence Dept.*, 1916, pp. 16, figs. 3).—A summary of practical information on this subject.

Some winter observations of muscid flies, M. KISLUK, JR. (*Ohio Jour. Sci.*, 17 (1917), No. 8, pp. 285-294).—This paper is based upon experiments conducted at College Park, Md., during 1914-15, and continued at Columbus, Ohio, during 1916-17. They show the greatest length of life of adults under winter conditions to be 44 days (December 12, 1914, to January 29, 1915, extreme temperatures 15 to 63°, mean 45°) in the unheated stable, and but 30 days (December 16, 1914, to February 2, 1915, extreme temperature 13 to 82°, mean 30°) in the insectary. Eggs were not deposited in the insectary until April 20, while in the stable they were noted on May 6.

Under natural conditions neither eggs nor maggots were found alive in the normally preferred situations, although the maggots will probably be found in early winter. The adults were not collected during the winter proper in houses where it was formerly supposed they were hiding. Apparently under natural conditions the house fly hibernates as pupa.

The author's observations indicate that many of the other common flies hibernate in the larval and pupal stages, including *Lucilia sericata*, *Phormia regina*, *Calliphora erythrocephala*, *C. vomitoria*, and *Cynomyia cadaverina*. *L. casar* may spend the winter in the larval stage, and there is plenty of evidence that *Pollenia rudis* hibernates as an adult, although the apparent appearance of fresh spring specimens suggests that it also hibernates in the immature stages.

Florida and the Mediterranean fruit fly, E. A. BACK (*Quart. Bul. Plant Bd. Fla.*, 1 (1917), No. 4, pp. 159-171, pls. 2, figs. 5).—In this general account the author calls attention to the disastrous results that would follow should this fly gain entrance to Florida.

The apple maggot in Nova Scotia, W. H. BRITAIN and C. A. GOOD (*Nova Scotia Dept. Agr. Bul.* 9 (1917), pp. 70, pls. 7, figs. 3).—This bulletin is based upon a careful inspection of maggot-infested territory of Nova Scotia, and upon experimental work by the junior author during the seasons of 1914 and

1915, an account of which has been noted (E. S. R., 35, p. 853). Since that time additional investigations have been carried on by the senior author.

"The emergence of the flies in summer varies greatly with season and locality; they may appear early in July and are usually present in numbers by the third week, the maximum emergence occurring in the early part of August. They continue to emerge, however, throughout the month of August and well into September. Several days after emerging the eggs are laid by the female beneath the skin of the fruit, one in a place. The flies feed on the waxy substance on the surface of the fruit, first moistening any solid particles with saliva ejected from the mouth.

"The eggs hatch in from 5 to 12 days and the larvæ feed for a varying length of time within the fruit, burrowing through it in all directions until it is honey-combed by their tunnels. The pupal stage is passed in the soil, and the winter is spent in this state. A proportion of the flies remain over another winter as pupæ."

Experiments indicate that a method cheaper and easier than destroying the fallen fruit may be found in the use of arsenical sprays. "The use of arsenate of lead 2 lbs. to 40 gal. of water, applied once when the first flies were observed, which in the average season will be about July 15, and again two weeks later, gave excellent results even in a very wet season. It will usually be sufficient to defer the last summer spray until about the end of the first or second week in July, repeating the application near the end of the month. When it is necessary to apply a fifth summer spray for apple scab, the addition of arsenate of lead will enable it to serve as the first maggot spray. It is particularly important to have the trees well covered with the poison through the early part of August, for this is the time when the greatest number of eggs are laid. The addition of molasses to this spray does not appear to make the poison more attractive to the flies as was formerly supposed, and the experiments undertaken show little if any benefit from its use. From a practical standpoint it is not safe to defer the first spray until flies are actually seen in the orchard, as considerable damage may be done before this time."

Danish Diptera, W. LUNDBECK (*Diptera Danica*. Copenhagen: G. E. C. Gad, pt. 3 (1910), pp. 329, figs. 141; pt. 4 (1912), pp. 416, figs. 130; pt. 5 (1916), pp. 603, figs. 202).—These volumes, in continuation of those previously noted (E. S. R., 21, p. 154), deal with the Empididæ, Dolichopodidæ, and Lonchopteridæ and Syrphidæ, respectively.

A monographic study of the parasitic Diptera of Africa, II, J. RODHAIN and J. BEQUAERT (*Bul. Sci. France et Belg.*, 50 (1916), No. 1-2, pp. 53-165, pls. 2, figs. 30; *abs. in Rev. Appl. Ent.*, Ser. B, 5 (1917), No. 4, pp. 49, 50).—The second part of the paper previously noted (E. S. R., 36, p. 359) consists of a revision of the Cestrinæ on the African Continent.

The rough-headed cornstalk beetle in the Southern States and its control, W. J. PHILLIPS and H. FOX (*U. S. Dept. Agr., Farmers' Bul.* 875 (1917), pp. 10, figs. 8).—This account relates to (*Ligyris*) *Euetheola rugiceps*, a robust scarabæid beetle which has been increasing in importance in recent years and has caused serious damage to corn crops in the Southern States, a noteworthy outbreak having occurred in the tidewater section of Virginia during the early summer of 1914. It appears to be confined entirely to the Southern States, there being no record of its occurrence north of Virginia, Kentucky, and Kansas.

The injury to corn is caused entirely by the adult beetle and occurs only during the spring and early summer. In Virginia it was confined to low, poorly drained lands in the eastern section of the State. The beetles begin

to attack the crop as soon as the plants appear above ground and continue their attack until the plants are knee-high or even somewhat taller. They bore into the outer wall of the stalk immediately below the surface of the ground, making a large, ragged opening, and destroy the tender growing point or "heart," upon which this beetle appears to feed especially. This results in the withering of the central roll of leaves, the other leaves retaining their freshness for a considerable longer period.

The eggs are laid during the early summer, chiefly during June, and are deposited singly or in groups of three or four in the ground wherever the beetles happen to be feeding. They hatch in about two weeks and reach full growth in about two months, two weeks being passed in the pupal stage. The adults appear about the middle of September and soon go into hibernation, there being but one generation a year. Observations of its habits show that one of the most promising methods for controlling the beetles is to avoid maintaining pastures for indefinite periods or allowing any part of the farm to grow up as waste land. The control measures are here summarized by the author as follows:

"Eliminate all old pastures or waste land, especially low, moist areas, and drain such lands thoroughly. Pasture hogs in waste or pasture lands that can not be conveniently drained and cropped. Plant corn early, say about April 20 for tidewater Virginia and earlier for more southerly localities. Give liberal applications of barnyard manure or commercial fertilizers whenever practical. Employ children or cheap labor to collect and destroy the beetles when a field first shows injury. Do not allow corn to follow sod if possible to avoid it. Plow sod land in late summer and early fall in order to destroy the pupæ of the rough-headed cornstalk beetle."

A list of the Japanese and Formosan Cicadidæ, with description of new species and genera, S. MATSUMURA (*Trans. Sapporo Nat. Hist. Soc.*, 6 (1917), No. 3, pp. 186-212).—The author finds that in Japan and Formosa there are 59 species representing 28 genera, of which 14 species and 6 genera are new.

Honeybees in relation to horticulture, B. N. GATES (*Trans. Mass. Hort. Soc.*, 1917, pt. 1, pp. 71-88).—This lecture, delivered before the Massachusetts Horticultural Society on February 24, 1917, deals with pollination, the need of honeybees in the setting of crops, bees for the horticulturist, fruits and vegetables pollinated by bees, securing and maintaining bees, alleged injury to fruit by honeybees, injury to cultivated flowers, and spraying v. beekeeping (E. S. R., 35, p. 662).

Thirty-seventh annual report of the Beekeepers' Association of the Province of Ontario, 1916 (*Ann. Rpt. Bee-Keepers' Assoc. Ontario*, 1916, pp. 62, figs. 5).—The proceedings of the association are reported.

Notes on the Egyptian honeybee, L. GOUGH (*Bul. Soc. Ent. Egypte*, 9 (1916), No. 1, pp. 25-32).—These notes relate to the bionomics of *Apis fasciata*.

Foul brood of bees; its recognition and treatment, H. GARMAN (*Kentucky Sta. Circ.* 17 (1917), pp. 99-106, figs. 3).—This is a popular summary of information.

Life history of the larval forms of *Adelura gahani* n. sp., a braconid parasite of phytomyzid larvæ, G. DE LA BAUME-PLUVINEL (*Arch. Zool. Expt. et Gén.*, 55 (1916), No. 3, pp. 47-59, pl. 1, figs. 3; abs. in *Jour. Roy. Micros. Soc.*, No. 2 (1917), pp. 216, 217).—An account is given of the life history of the internal parasite of a phytomyzid larva which mines in the leaves of *Ancollas* (*Aquilegia*), described as new under the name *Adelura gahani*.

Description of a new hymenopteran (*Anteris nepæ*) parasitic on the eggs of *Nepa*, C. FERRIÈRE (*Arch. Zool. Expt. et Gén., Notes et Rev.*, 55 (1916), No. 4

pp. 75-80, *figs. 4*; *abs. in Jour. Roy. Micros. Soc.*, No. 2 (1917), p. 216).—Under the name *Anterioris nepa* a parasite which develops in the eggs of *Nepa* is described as new.

FOODS—HUMAN NUTRITION.

The nutritive value of margarins and butter substitutes with reference to their content of the fat-soluble accessory growth substance, W. D. HALLIBURTON and J. C. DRUMMOND (*Jour. Physiol.*, 51 (1917), No. 4-5, pp. 235-251, *figs. 17*).—From experiments on rats the authors draw the following conclusions:

"The fat-soluble accessory growth substance is present in beef-fat and 'oleo-oil' and is present in margarins prepared upon such a basis. Such margarins are nutritively the equivalent of butter.

"Coconut oil, cottonseed oil, arachis oil, and hydrogenated vegetable oils contain little or none of this accessory substance, hence margarins prepared with a basis of these fats have not an equal nutritive value to that of butter. Nut butters prepared from crushed nuts and vegetable fats are similarly not equal to butter.

"Lard substitutes prepared from vegetable oils are equal to lard in their nutritive value, both alike being destitute of the fat-soluble accessory substance."

Edible fats, in war and law, D. WESSON (*Jour. Indus. and Engin. Chem.*, 10 (1918), No. 1, pp. 71-73).—A statement of the fat situation in this country, with comment on the oleomargarin and filled cheese laws.

Butter as a vehicle of infection in typhoid, M. F. BOYD (*Jour. Amer. Med. Assoc.*, 69 (1917), No. 24, pp. 2030-2032).—A report of two outbreaks of typhoid, in one of which the epidemiological evidence implicating butter was considered conclusive, in the other merely suggestive. In neither case was the cream pasteurized. The author comments that attenuation and diminution of the numbers of typhoid bacilli in the presence of lactic acid and the salt in the butter prevents it from being as great a menace as infected milk.

The distribution of milk (*Roy. Soc. [London], Food (War) Com.*, 1917, Nov. 20, pp. 3).—The committee recommends that due to the probability of a milk shortage, a priority scheme for milk distribution be adopted. Persons needing milk are divided into six groups, as follows: Infants from birth to 9 months, 1½ pts. per day; 10 to 18 months, 1½ pts. per day; 19 months to 5 years, 1 pt. per day; 6 to 14 years, 1 pt. per day; all other healthy persons, ½ pt., or according to the supply available; and sick persons and pregnant women, according to medical certificate. In case of shortage they would receive preference in the order listed, group 6 ranking with (1) and (2).

A study of Puget Sound oysters, EDITH F. HINDMAN and F. J. GOODRICH (*Amer. Food Jour.*, 12 (1917), No. 11, pp. 611-614).—The article includes results of bacteriological analyses of oysters and their liquor under different conditions of handling.

The manufacture of meat food products, R. D. MACMANUS (*Amer. Food Jour.*, 12 (1917), No. 10, pp. 559-563, *figs. 6*).—This gives a description of the methods of handling the animals and the manufacture of by-products.

The sterilization of unsound meat, W. J. HOWARTH (*Jour. State Med.*, 25 (1917), No. 6, pp. 161-168).—The author concludes that in England it would be very unwise to undertake the sterilization of unsound, condemned meat with the object of subsequently selling the meat to the public.

Memorandum on the uses of maize or Indian corn, W. H. THOMPSON (*Roy. Soc. [London], Food (War) Com. Memo.*, 1917, Apr. 20, pp. 5).—Data are included on the composition, varieties, products, and digestibility of maize.

Manufacture of corn starch, corn sirup, and corn sugar, A. P. BRYANT (*Amer. Food Jour.*, 12 (1917), No. 3, pp. 511-515, figs. 7).—The methods of manufacture are described.

Cottonseed products, K. H. VAKIL (*Jour. Soc. Chem. Indus.*, 36 (1917), No. 13, pp. 685-692, figs. 10).—This article describes methods of treating the seed, variations in varieties from different countries, and the composition and use of the products.

The composition and relative economy of some bread sold in Washington, D. C., M. A. POZEN and M. STARBECKER (*Amer. Jour. Pub. Health*, 7 (1917), No. 6, pp. 570-572).—It is stated that the purchasing power of the penny in Washington has shrunk 21.5 per cent in the case of six-cent loaves and 13.1 per cent in the case of five-cent loaves since November, 1916. On the basis of protein and total solids content, the four-cent loaf was found the most economical, followed by the ten, five, twelve, and six-cent loaf in the order named.

Preservation of vegetables by fermentation and salting, L. A. ROUND and H. L. LANG (*U. S. Dept. Agr., Farmers' Bul.* 881 (1917), pp. 15, fig. 1).—The object of this publication is to describe and explain methods of preservation by fermenting and salting, to indicate the purpose for which they are specially applicable, and to tell how the preserved products can best be prepared for table use.

Preservation by fermentation may take place by packing with layers of dry salt (3 lbs. to 100 lbs. of vegetables) and keeping in a warm place under pressure until fermentation occurs. When fermentation stops, the container is set away in a cool place and covered with paraffin or otherwise made air-tight. Cabbage, string beans, and greens may be preserved in this way. For less watery vegetables a brine is used containing, in each gallon of water, $\frac{1}{2}$ pt. of vinegar and $\frac{1}{4}$ cup of salt. In both cases it is the formation of lactic acid from the sugars extracted from the vegetables that acts as the preservative.

To salt vegetables, 25 lbs. of salt are used to 100 lbs. of vegetables, in which proportion yeasts and molds are prevented from growing. The salt and vegetables are packed in alternate layers and are under pressure for 24 hours. If they are not then covered with brine, enough brine (1 lb. salt in 2 qts. water) is added to cover.

Methods for preparing for the table vegetables preserved in this way are included.

Imitation or pseudo coffees.—Many substitutes to which the war has called attention (*Sci. Amer. Sup.*, 84 (1917), No. 2187, pp. 340, 341, figs. 9).—A description of the plants used in place of coffee is given.

[Food conservation and other patriotic topics], **E. F. LADD and ALMA K. JOHNSON** (*North Dakota Sta. Spec. Bul.*, 4 (1917), No. 16, pp. 395-410).—This number, called a Patriotic Number, makes an appeal for food conservation, thrift, and similar topics.

Food production, conservation, and distribution (*U. S. House Representatives*, 65. Cong., 1. Sess., *Hearings Com. Agr.*, 1917, pp. 538).—Hearings on various measures relative to the production and conservation of food supplies are given.

The national food policy.—The danger of restricting the consumption of meat (*Roy. Soc. [London], Food (War) Com.*, 1917, Mar. 30, pp. 1-3).—The report of this committee shows that in the United Kingdom cereals normally constitute 34 per cent of the food energy, of which 30 per cent is from wheat; meat, including poultry and game, furnishes 18 per cent; dairy products 15 per cent; sugar 13 per cent; potatoes 8 per cent; and other items (fruit, fish, etc.) 12 per cent. It is advised that a full supply of cereals be maintained; that maize, barley, rice, and other grain be reserved for human consumption;

that individual consumption be reduced to the minimum required for efficiency, but that no special restriction be placed on meat consumption; that the number of cattle, sheep, and pigs be reduced; and that the importation of cereals be increased and the importation of meats decreased.

Investigation of workers' food and suggestions as to dietary. L. E. HILL (*Min. Munitions [Gl. Brit.], Health Munition Workers Com. Memo. 11 (1916), pp. 11*).—Studies showed that meals served at canteens to munition workers have an energy value of about 1,000 calories and are well balanced as to protein, fat, and carbohydrate. The cost compares very favorably with similar meals at cafés. Comparisons are also made with meals brought from home. In hotels erected for munitions workers, the dietary was found to average 3,695 calories per man per day.

Suggested daily dietaries with analyses and costs are appended.

The family budgets and dietaries of 40 labouring class families in Glasgow in war time. MARGARET FERGUSON (*Proc. Roy. Soc. Edinb., 37 [1916-17], No. 2, pp. 117-136*).—Forty representative families were studied whose average income was 30s. 4 d. The caloric value of the diet averaged 3,297 calories per man per day, and the protein 102 gm. per man per day. Forty-eight per cent of the energy value was obtained from cereals, and 40 per cent from bread. The average cost in 1915-16 had increased 36.4 per cent above that in 1911. In November and December, 1915, the average value obtained for 1d. was 390 calories and in the spring of 1916 it was 305 calories.

The food requirement in infancy (*Jour. Amer. Med. Assoc., 69 (1917), No. 14, p. 1175*).—This review of recent work shows that in new-born infants at complete rest, the metabolism does not exceed 48 calories per kilogram of body weight per day. Between two months and one year it increases to 60 calories. Between two and six months the muscular activity may increase the metabolism 67 to 70 per cent over the basal metabolism at rest. It is suggested that if the infant is very quiet, 15 per cent should be added, if normally active 25 per cent, and if extremely active about 40 per cent. There should also be added 15 per cent for energy lost in the excreta and 20 per cent for growth. If the food contains a large proportion of protein (cow's milk) it will have to have greater fuel value than if human milk is fed because of the stimulating effect of the protein.

These requirements refer to normal infants.

The metabolism of arginin. W. H. THOMPSON (*Jour. Physiol., 51 (1917), No. 3, pp. 111-153*).—Arginin carbonate given with food to dogs cause an increase of total creatinin in the urine of 10 per cent on a meat-free diet. With birds the increase was 22.6 per cent. When given hypodermically or by intravenous injection to dogs on a meat-free diet, the increase in creatinin in the urine was 22.5 per cent over the normal. In rabbits the creatinin excretion was 80 per cent above normal. The addition of arginin to the food of birds and dogs had no effect on the excretion of preformed creatinin. When arginin was given in the food for two or more periods with intervals between a decreased output of creatinin was found.

Observations on the excretion of arginin show that the partition of its nitrogen in the urine of dogs was on the average as follows: (a) Arginin carbonate given with food—total nitrogen 56.5 per cent, urea nitrogen 34.7 per cent, ammonia 13.7 per cent, amino-acid nitrogen 2.33 per cent, nitrogen as total creatinin 3.47 per cent; (b) arginin carbonate subcutaneously injected—total nitrogen 67.87 per cent, urea nitrogen 35.4 per cent, ammonia 4.05 per cent, amino-acid nitrogen 4.7 per cent, and nitrogen as total creatinin 4.12 per cent.

The vitamin hypothesis in relation to alleged deficiency diseases (*Jour. Amer. Med. Assoc., 69 (1917), No. 24, pp. 2040, 2041*).—A survey of recent works

on so-called deficiency diseases, which seems to show that beri-beri and xerophthalmia are due to the absence of a specific unidentified factor, but that pellagra and scurvy are not due to such a factor. There is doubt whether scurvy is a distinct entity, and the theory of infection in pellagra is still a possibility.

ANIMAL PRODUCTION.

The nutrition of farm animals, H. P. ARMSTRONG (*New York: The Macmillan Co., 1917, pp. XVIII+743, figs. 45*).—This work does not claim to be another edition of facts in feeding, but treats as far as possible with our present scope of knowledge of the fundamental laws governing the nutrition of farm animals. The animal body is treated as a transformer of energy partly into motion and incidentally into a reserve material which can be utilized as human food. It is the latter phase which this volume presents.

The work is divided into four parts. The first deals with materials of nutrition, the food compounds of plants and animals and the composition of cells, tissues, and organs. Part 2 deals with the physiology of nutrition or the methods of transference and building in the animal organism. Part 3 treats of the needs of animals and the amounts of matter and energy necessary in producing the materials or work for which they are kept. The fourth part considers the feed supply, values, and rationing. An appendix exhibits tables of the maintenance, fattening, milk and work production requirements of different animals, and the food values of various feeding stuffs.

The work deals with the natural laws governing the nutrition of farm animals rather than with the broader field of animal husbandry. It is, therefore, intended for the student with some knowledge of chemistry and physics and not for the general farmer.

The direct and indirect effects of X-rays on the thymus gland and reproductive organs of white rats, EVELYN E. HEWER (*Jour. Physiol., 50 (1916), No. 7, pp. 438-458, fig. 1*).—A study was made of the direct effects of X-rays on the thymus and male and female gonads of white rats, and of the indirect effects of the rays on nonirradiated organs.

Irradiation of the thymus only causes slight degeneration of the male gonads and delay of sexual maturity, but no alteration in the female. Irradiation of the whole animal when very young with a very small dose hastens sexual development in the male. Irradiation causes a degeneration of the testes. The more immature the testes and sperm cells the more easily they are affected by X-rays. Irradiation of the male and female gonads has a marked indirect effect on other organs, especially on the thymus. Primordial and young ova are more resistant to the action of X-rays than older follicles. The corpora lutea become abnormally vascular, but appear otherwise unchanged. Hypertrophy of the interstitial gland is constant, and persists even after apparent regeneration of the ovary.

A list of 19 references is included.

The numerical results of diverse systems of breeding, with respect to two pairs of characters, linked or independent, with special relation to the effects of linkage, H. S. JENNINGS (*Genetics, 2 (1917), No. 2, pp. 97-154*).—In this continuation of the study of methods of measuring results of systems of breeding (*E. S. R., 34, p. 764*), the author gives formulas for finding in later generations the results of continued breeding by a given system when two pairs of characters, linked or independent, are considered. The systems of breeding considered are (1) random mating, (2) selection with respect to a given single character, (3) assortative mating with respect to a single character, and (4) self-fertilization. In each system two cases are dealt with, that in

which linkage is the same in both sets of gametes, and that in which linkage is complete in one set.

In each system general formulas are derived for transforming generation n into generation $n+1$. In several systems special formulas are given for finding directly in any later generation n the proportions of the population, when one begins with parents that are a cross between $ABAB$ and $abab$, or between $AbAb$ and $aBaB$. With regard to selection and assortative mating with respect to a single character, formulas are given for the effect on the single pairs taken separately; thus, for the effect of selection or assortative mating with respect to one character on the distribution of another character linked with that one. The formulas are collected for convenience in 31 tables in the appendix.

Some breeding properties of the generalized Mendelian population. E. N. FORSTWORTH and B. L. REMICK (*Genetics*, 1 (1916), No. 6, pp. 608-616).—Some properties of mating a generalized Mendelian population $r AA + s Aa + t aa$ are considered in this paper, random mating (two types of assortative mating and mating of dominants alone) being considered. Formulas are presented which will give the expected proportions of AA , Aa , and aa in any generation resulting from the practice of such matings.

Studies on inbreeding.—VIII, A single numerical measure of the total amount of inbreeding. R. PEARL (*Amer. Nat.*, 51 (1917), No. 610, pp. 636-639, p. 1).—The author describes a single numerical constant which has been devised to supplement or replace the inbreeding curve (E. S. R., 38, p. 65) as a designation of the total inbreeding exhibited in a particular individual. By the method it is seen that American Jersey cattle, as judged by random samples of the general population, are about 28 to 30 per cent as closely inbred as the maximum possible amount, taking account of the first eight ancestral generations as a whole.

Tricolor inheritance.—II, The Basset hound. H. L. ISEN (*Genetics*, 1 (1916), No. 4, pp. 367-376, figs. 2).—This part of this series (E. S. R., 35, p. 770) discusses the probable genetic factors involved in the production of the coat color of Basset hounds, the relation of these factors to each other, and test matings which could be made to determine how closely the factors and relationships proposed fit the actual cases.

Basset hounds are of two kinds, (1) tricolors, and (2) tan-and-whites. Black-and-whites do not occur in the breed. Tricolors are described as "black, tan, and tan, the head, shoulders, and quarters a rich tan, and black patches on the back." Tan-and-whites have tan heads and "tan is often found on the back."

The factors involved in color inheritance in Basset hounds are (1) B , the factor for black, always present in Bassets; (2) E , the extension factor which extends the black (or chocolate) and may be present or absent; (3) T , the factor for uniform pigmentation (animals without T are either black-and-tan, tan-and-tan, or red (tan) and lemon; T is always absent in Bassets); and (4) R , the factor which inhibits the formation of black (or chocolate) pigment in the coat (it is questionable whether this factor is ever present in Bassets). Tricolors may be of the formula $BBEettR$ or $BBEettRr$. Ee tricolors mated together get some ee offspring which are tan-and-whites and which would breed true. These may have tan spots on the back. In this case, when T is absent, the tan on the head should be of a lighter shade than the tan on the back. If R is present in Bassets then $BBEe$ (or Ee) tRr tan-and-whites (with tan on the back) bred together should get some tricolor offspring. This can not be determined from available data.

Tricolor inheritance.—III, Tortoise-shell cats. H. L. ISEN (*Genetics*, 1 (1916), No. 4, pp. 377-386).—The author reviews the work of others and offers

an explanation of the inheritance of tortoise-shell coat color or black-and-orange spotting in cats. This is followed by a general comparison of tricolor in guinea pigs, Basset hounds, and cats.

[Miscellaneous experiments in animal husbandry] (*Pennsylvania Sta. Bul.* 147 (1917), pp. 3-14, figs. 6).—A number of short articles are included.

Swine fattening experiment.—This was made to test the value of nitrogenous supplements to corn and different methods of preparing corn in pig feeding. Thirty-five pigs, weighing about 110 lbs. each, were divided into five lots of seven pigs each and fed from November 10, 1916, to February 2, 1917. Lot 1 on shelled corn and tankage (10:1) made an average daily gain per head of 0.93 lb., at a cost of 8.45 cts. per pound of gain; lot 2 on corn meal and tankage (10:1) gained 1.19 lbs., at a cost of 8.66 cts. per pound; lot 3 on corn meal and linseed meal (7:1) gained 0.51 lb., at a cost of 15.1 cts. per pound; lot 4 on corn meal and chopped alfalfa hay (4:1) gained 0.31 lb., at a cost of 20.17 cts. per pound; and lot 5 on ear corn ad libitum and 4 lbs. of tankage per 1,000 lbs. of live weight daily gained 0.99 lb. at a cost of 7.83 cts. per pound.

Brood sows.—Four lots of four brood sows each were maintained during the gestation period (114 days) on the following rations: Lot 1 on alfalfa hay at an average cost of \$5.60 each; lot 2 on alfalfa hay ad libitum and 1 lb. of shelled corn daily per 100 lbs. live weight at a cost of \$10.46; lot 3 on a mixture of shelled corn and tankage (10:1) fed at the rate of 2 lbs. per 100 lbs. live weight at a cost of \$7.22; and lot 4 equal parts of corn meal, ground oats, and wheat middlings fed at the rate of 2 lbs. daily per 100 lbs. live weight at a cost of \$25.23. All lots gained in weight except lot 1. The pigs farrowed in lot 4 were not so uniform and vigorous as those in the other lots.

A cross-breeding experiment with sheep.—The plan is noted.

Maintenance of breeding flocks of mutton and wool sheep.—Further notes are given on the progress of this work, begun in December, 1911. The only change made during the year was in the rations fed the ewes during the winter. The general conclusion from the season's feeding was that the lambs produced on the various rations were very similar and that the cost of alfalfa hay was greater than mixed hay. Comparisons are drawn between the Shropshire and the Delaine Merino ewes as shown by the 5½ years of investigation.

The maintenance of a beef breeding herd.—Previously noted in detail from Bulletin 138 (*E. S. R.*, 35, p. 168).

Steer feeding experiments.—During the year 72 head of steers were fed under two lines of investigation. In the first, five lots of 12 steers each were used to test the feeding value of rations for medium weight cattle under Pennsylvania conditions. The results indicated a marked advantage in using silage as roughage for feeding cattle. The steers receiving no corn except that in silage made an average daily gain per head of 2.08 lbs. during 140 days. The shrinkage with the silage-fed cattle was a little greater, while those receiving a heavy silage ration with a small amount of corn stover had the least shrinkage. Those on a heavy silage ration sold for a higher price and gave the greatest profit.

In a comparison of broken ear corn or shelled corn with corn-and-cob meal or corn meal with two lots of 6 steers each, the former had a larger amount of profit to its credit, but the latter produced heavier daily gains, a better finish, and sold for a higher price, and made the greater profit.

Studies in the making of corn stover silage.—It was found that corn stover can be cut successfully in an ordinary silage cutter. In corn stover silage making, twice the amount of water by weight should be added. Chemical and bacteriological tests showed the same fermentations as in ordinary corn silage. *Mat*

imum temperature readings for over two months were 60° F., as high as in ordinary corn silage in some instances. While no feeding tests were made, the cattle ate the stover silage with relish and consumed more of it than dry fodder and with less waste and labor than with dry stover.

[Work in animal husbandry at the Nebraska Station] (*Nebraska Sta. Rpt.* 1916, pp. VII-XI).—Work of the station in sheep and cattle feeding is reported.

Sheep feeding.—In December, 1915, 300 Wyoming lambs were entered in a 75-day experiment to determine the amount of corn to be fed with alfalfa, the supplementary feeds best to use with corn, and feeding in the open v. feeding in sheds. The best results were obtained from feeding 0.86 lb. of corn daily with alfalfa. With corn silage added to the corn-alfalfa hay ration the animals showed more finish and made gains at an average cost of 4.95 cts. per pound, as compared with 4.9 cts. on the corn and alfalfa ration, 5.43 cts. for corn, oil meal, and alfalfa hay, 5.15 cts. for corn, cottonseed meal, and alfalfa hay, and 5.18 cts. for corn, cold pressed cottonseed cake, and alfalfa hay.

The addition of the supplementary feeds (oil meal, cottonseed meal, and cold pressed cottonseed cake) to the ration increased the gains sufficiently so that the profits per head were larger with their use. The lambs fed in the open consumed more feed, made greater gains, and returned a larger profit than those fed in sheds.

In August, 1916, Oregon lambs were divided into eight groups of 40 each to determine the relative gains and cost made in the dry lot, pasture, and on stover in the field. The results again showed the cheapest gains on pasture, 4.50 cts. per pound. In the dry lot the lambs on a heavy corn ration made an average profit per head of \$1.65 and on a medium ration \$1.34; on pasture a profit of \$1.77; and where used to feed down corn in the field a profit of \$2.40. Clipping the lambs increased the gains but reduced the selling price to a point making the practice unprofitable.

Cattle feeding.—An experiment was made with six lots of cattle comparing corn and alfalfa hay with corn, alfalfa hay, and silage, and with corn, alfalfa hay, and supplementary protein feeds. The average net profits per steer, including pork produced, were as follows: Ground corn and alfalfa hay, \$11.18; shelled corn, alfalfa hay, and silage, \$13.71; shelled corn and alfalfa hay, \$14.22; shelled corn and cottonseed meal the last six weeks, \$15.16; shelled corn, alfalfa hay, silage the first four weeks, and Tarkio molasses the last 14 weeks, \$15.47; and shelled corn, alfalfa hay, and cottonseed meal, \$16.70.

Wintering two-year-old steers preparatory to finishing on grass the following summer, R. E. HUNT (*Virginia Sta. Bul.* 215 (1917), pp. 3-15, figs. 5).—The usual method of wintering steers in Virginia is on dry roughage and grain. The experiments reported covered three winters and compared the feeds commonly used with corn silage and combinations especially.

As concentrated feeds with silage, cottonseed meal and corn meal were used, and as roughage, mixed hay, wheat straw, and corn stover were used. Five lots of five steers each were employed and the rations varied for each year's work. The experiments were carried out in the open with sheds for shelter. The seasonal differences are noted and the gains and losses in weight displayed in graphs. From the three year's work the following conclusions are drawn: In buying two-year-old cattle in the fall for fattening they were carried through the winter on a maintenance ration and made their gains on grass during the following summer. When the steers were wintered on silage they made more rapid gains on grass in the spring with practically no loss in weight in making the change, while steers wintered to gain flesh lost weight while becoming used to the watery and immature grass of early spring. Steers in

thin condition made rapid gains at first when turned on grass. Steers fed 45 lbs. of silage daily made the greatest gains at the lowest cost, while those fed corn stover and corn meal made the least gains at the greatest cost. The animals fed 45 lbs. of silage made smaller gains than those fed only 40 lbs. Replacing 10 lbs. of silage in the ration with 1 lb. of cottonseed meal gave good results during the winter, but the steers did not do so well when they were turned to grass. Thirty-five lbs. of silage with 1 lb. of cottonseed meal was more satisfactory. Mixed hay was a better additional roughage with silage than either straw or stover.

The following suggestions are made: Winter 1,000-lb. steers to maintain equal weights until spring; winter 1,100-lb. steers to lose about 25 lbs. during the winter; and winter 1,200-lb. steers to lose about 50 lbs. by spring.

Preparation of corn for fattening two-year-old steers, H. O. ALLISON (Missouri Sta. Bul. 149 (1917), pp. 35, figs. 11).—The investigations reported were made to determine the most effective form in which corn can be fed to 2-year-old steers. The trials were made with 90 head of 2-year-old steers, 30 head of cattle in 5 lots of 6 each being used each season throughout a period of three years.

To rations made up of a nitrogenous concentrate, corn silage, and legume hay, there was added for lot 1 broken ear corn, lot 2 shelled corn, lot 3 crushed corn and cob, lot 4 corn-and-cob meal, and lot 5 ground corn. The nitrogenous concentrate consisted of cottonseed meal or cake and the legume hay of alfalfa for the first and third periods and clover for the second. As nearly as possible the proportion of corn to the nitrogenous concentrates was kept at 6 lbs. of the former (shelled basis) to 1 lb. of the latter. Pigs weighing from 100 to 125 lbs. followed the cattle to utilize the feed which would otherwise have been wasted, there being 4 pigs in lots 1 and 2, 3 in lot 3, and 2 in lots 4 and 5. The data in detail are given in a number of tables. The average results of three trials are shown as follows:

Results of fattening steers with corn in different forms.

	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.
Average daily ration per steer:					
Corn.....lbs.	17.42	17.78	17.24	17.10	18.27
Nitrogenous concentrate.....do.	2.78	2.96	2.75	2.71	2.98
Corn silage.....do.	17.58	17.75	16.00	16.61	18.25
Legume hay.....do.	2.49	2.69	2.55	2.38	2.50
Average daily gain per steer.....do.	2.52	2.71	2.59	2.61	2.50
Gain made by cattle and pigs per bushel of corn fed.....lbs.	10.53	10.18	9.57	9.10	9.50
Percentage of gain per bushel of corn fed made by pigs.....	21.63	16.02	10.63	4.98	4.00
Dry matter fed per 100 lbs. gain made by cattle and pigs.....lbs.	762.44	642.31	877.78	936.42	697.88
Cost per 100 lbs. gain (pork credited).....	\$9.21	\$9.63	\$10.03	\$11.21	\$10.25
Shrinkage per head in shipping.....lbs.	32.98	34.56	27.26	31.15	28.00
Net profit per steer.....	\$4.00	\$2.85	\$0.85	\$1.17	\$2.40

¹ Loss.

Lot 5 (ground corn) brought the highest price per pound, while lot 4 (corn and-cob meal) came second, and lot 2 (shelled corn) third. The higher price, however, was not enough to offset the reduced gain in weight per unit of feed and the expense of preparing the corn.

Corn silage with and without shelled corn in rations for fattening steers, H. O. ALLISON (Missouri Sta. Bul. 150 (1917), pp. 24, figs. 7).—Some of the results obtained from two years' experiments in fattening steers by the use of corn silage as a maximum and shelled corn and protein concentrates as a

minimum ration are reported. The first trial, made from December, 1915, to May, 1916, covered 133 days, the second, from December, 1916, to May, 1917, covered 130 days. The feeders were of good grade bought on the Kansas City market, and after fattening were sold on the Chicago market. The lots in the first trial consisted of 6 steers each, those in the second trial of 8 each. The feeding gains and profits are shown in the following table:

Results of fattening steers on corn silage with and without shelled corn.

	First trial.					Second trial.				
	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.
Shelled corn, lbs. per steer	15.60	15.24			15.27	16.71	17.11			16.92
Cottonseed meal, do.	2.60		5.05			2.78		4.35		
Linseed oil meal, do.		2.54		5.05			2.85		4.35	
Corn silage, do.	17.47	16.47	36.22	37.62	16.26	29.74	30.08	47.97	49.41	26.93
Alfalfa hay, do.	3.69	2.27	3.00	4.03	3.90	3.25	3.78	5.09	5.62	3.94
Average daily gain per steer,										
pounds	2.72	2.45	1.97	2.38	2.20	3.03	3.26	2.40	2.46	2.64
Gain made by hogs per steer,										
pounds	38.66	51.10	16.40	3.10	36.33	84.95	106.58	1.78	5.16	66.50
Cost of feed per steer	\$40.85	\$38.63	\$26.07	\$27.44	\$33.88	\$86.01	\$88.25	\$44.79	\$45.71	\$77.12
Net profit per 100 lbs. gain made by										
cattle	\$10.42	\$10.58	\$10.15	\$8.57	\$10.88	\$19.01	\$17.55	\$14.28	\$14.06	\$19.08
Loss, per cent.	63.53	64.19	62.38	61.33	62.58	60.60	61.10	59.30	58.40	60.50
Percentage per head in ship-										
ment	48.89	39.44	43.11	39.71	30.09	55.70	40.41	71.25	56.58	44.70
Net profit per steer	\$6.77	\$9.32	\$9.87	\$14.56	\$10.53	\$0.01	\$10.07	\$11.59	\$15.62	\$0.52

¹ Loss.

The results obtained in the above trials were based on the following prices: First trial, feeders \$7.64 per 100 lbs., corn 70 cts. per bushel, corn silage \$4.50 per ton, cottonseed meal and linseed oil meal \$37 per ton, and alfalfa hay \$14 per ton; second trial, feeders \$8.45 per 100 lbs., corn \$1.50 per bushel, corn silage \$8.50 per ton, cottonseed meal and linseed oil meal \$45 per ton, and alfalfa hay \$15 per ton.

The records for lots 3 and 4 (without shelled corn) indicate the possibility of fattening from three to four steers per acre with corn fed as silage. While the average daily gain was not so large as when shelled corn was added to the ration it was satisfactory. The value of protein concentrates was shown by the record for lot 4, which produced gains at the lowest cost. Lot 3, with cottonseed meal in the ration, came second. The linseed meal ration, as compared with the cottonseed meal rations, showed a greater net profit per steer, and the gain made by hogs following the cattle was also greater. The results indicate that the difference in the market price of the cattle was not sufficient to justify the feeding of shelled corn in the first trial, but in the second it was justified with corn at \$1 per bushel and silage at \$6 per ton, but not with \$1.50 corn and \$8.50 silage.

The results of the two trials indicate that it is ordinarily advisable to add a high protein concentrate to a ration of shelled corn, corn silage, and alfalfa hay for fattening cattle.

Kentucky's opportunities as a sheep State, L. B. MANN (*Kentucky Sta. Rep.* 13 (1917), pp. 107-116, fig. 1).—Attention is called to the promising outlook in sheep husbandry brought about by the great decrease in flocks all over the world. In Kentucky during the past year there was a decrease of 170,000 head, and since 1913, a decrease of 165,000 head, or 12½ per cent of the total.

The leading factors favorable to sheep raising in the State are pointed out. The principal drawback is the danger from sheep-killing dogs.

Supplements to corn for fattening swine, W. L. ROBINSON (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 10, pp. 317-322, figs. 5).—While corn growing and pork production are closely related industries, attention is called to the fact that, for the best returns in feeding, corn must be supplemented with feeds that make up its deficiencies; namely, protein and mineral matter. Experiments are reported in which the supplements to corn used were skim milk, tankage, linseed meal, and soy beans.

In an experiment lasting 70 days with three lots of pigs averaging about 60 lbs. each the following gains are reported: With corn and tankage, 9:1, the average daily gains per head were 0.83 lb. and the profit above the cost of feed \$4.34; with corn and skim milk, 1:1, a daily gain of 1.16 lbs. and a profit of \$14.28; and with corn and skim milk, 1:3, a daily gain of 1.024 lbs. with a profit of \$10.23.

In another experiment lasting 105 days with 79-lb. pigs, the lot fed corn alone made an average daily gain per head of 0.881 lb. with a profit of \$3.50; the lot fed corn and tankage, 9:1, an average daily gain of 1.709 lbs. with a profit of \$28.31; while the third lot fed corn and skim milk, 1:1, averaged 1.635 lbs. daily with a profit of \$26.99.

In a third experiment lasting 105 days with 43-lb. pigs the lot fed corn alone made an average daily gain of 0.35 lb. and lost \$10.21; those on corn and tankage, 9:1, a gain of 0.899 lb. daily and a profit of \$12.38; those on corn and skim milk, 1:1, a gain of 0.956 lb. daily and a profit of \$14.50; and those on corn and skim milk, 1:3, a gain of 1.328 lbs. daily and a profit of \$22.07.

Based on two pigs in each lot, the dressing percentages with the lot receiving tankage were such as to make them worth 2 per cent more than the corn-alone lot, and those with skim milk in the ration 3.7 per cent more.

In an experiment with 145-lb. pigs fed for 84 days the following results were noted: With corn alone the pigs made an average daily gain of 1.47 lbs. per head and a profit of \$10.62; with corn and tankage, 9:1, an average daily gain of 2 lbs. and a profit of \$22.72; with corn and linseed meal, 5:1, an average daily gain of 1.85 lbs. and a profit of \$19.64; and with corn and ground soy beans, 5:1, an average daily gain of 1.62 lbs. and a profit of \$15.60.

The above results were obtained with the feeds valued as follows: Corn, \$1.68 per bushel; tankage, \$80 per ton; skim milk, \$10 per ton; soy beans and linseed meal, \$65 per ton; and hogs, \$15 per 100 lbs.

It is pointed out that in selecting supplements to feed with corn the prices of the materials should have due consideration; also other factors such as the age of the pigs. Skim milk, for example, gives higher returns with young pigs than with older ones.

The disposal of city garbage by feeding to hogs, F. G. ASHBROOK and J. D. BEBOUT (*U. S. Dept. Agr., Office Sec. Circ. 80* (1917), pp. 8, pl. 1).—The Department is making a study of the handling of garbage, with the object of reducing the cost of handling and utilizing a waste product as a productive material. From the statistics of 17 cities it was found that in seven feeding their garbage to hogs the annual cost per capita was 11.6 cts., while in 10 disposing of it by other methods the cost was 33.7 cts.

The equipment for a garbage-feeding plant for hogs is shown and described. The collection and handling of garbage, the feeding and breeding of hogs using garbage, and the character of the meat are discussed.

The horse: His breeding, care, and treatment in health and disease, H. C. MERWIN (*Chicago: A. C. McClurg & Co., 1917, pp. XIV+281, pls. 13*).—A practical treatise on the breeding, care, and training of the horse, and a descrip-

tion of types and breeds. Disease and injuries are treated in part 2. A bibliography is appended.

Selection of breeding draft horses, C. N. ARNETT (*Montana Sta. Circ.* 69 (1917), pp. 17-32, figs. 15).—This circular treats in a general way of the judging and selection of draft breeding stock.

Distribution of public service stallions in Wisconsin in 1917, A. S. ALEXANDER (*Wisconsin Sta. Bul.* 283 (1917), pp. 64, figs. 4).—The total number of pure-bred sires has fallen from 1,814 in 1916 to 1,723 in 1917, while stallions of all kinds have fallen from a total of 3,062 in 1916 to 2,804 in 1917. However, the percentage of pure-bred stallions has increased from 59.2 in 1916 to 61.5 in 1917. It is estimated that there were 715,000 horses in Wisconsin January 1, 1917, with an average value of \$120 each.

A directory is given of the owners of public service stallions and jacks in the State.

The feminization of male birds, H. D. GOODALE (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 3 (1917), No. 9, pp. 68, 69, 70).—An account of the successful feminization of four cockerels by completely castrating and then implanting fresh ovarian tissue from related females.

In the four cases it was noted that (1) the birds had the plumage of the hen throughout, (2) the comb and wattles grew much more than those of the cock and reached a size approximately that of the hen, (3) the spurs developed apparently nearly as much as in the normal male of corresponding age, but as none of the living birds were sufficiently old no statement relative to their continued growth with advancing years could be made, (4) the general build of the birds was more like that of the cock than that of the hen, in that they were rather coarse and rangy, but not more so than some individual cocks, and (5) one of the birds was quite masculine and two were practically neutral in behavior. The fourth died before maturity.

The condition of implanted tissue has been ascertained in two instances. It was found that several pieces of the implanted tissues had been attached at various places. In some the blood supply was well developed and some evidence of increase in the size of the ova was noted, the largest reaching a size of 3 mm. There has been no evidence, however, that the ova had exceeded this size.

Sex-linked inheritance of [spangling in poultry], E. H. RUCKER (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 3 (1916), No. 1, pp. 6, 7).—Results are given of experiments which indicate that the factor of spangling in the Silver Spangled Hamburg is sex-linked. However, the inheritance may be modified by the presence of disturbing factors.

In the experiments the initial crosses were made reciprocally between the Silver Spangled Hamburg and the Brown Leghorn. The males derived from reciprocal crossings were practically alike, having spangled bodies with black tails, with the exception of four males which were entirely black. These black males later gave the same breeding results as their spangled brothers. The daughters of the reciprocal crosses were strikingly different. Those from Brown Leghorn $\delta \times$ Silver Spangled Hamburg ϕ were black with various degrees of brown stippling on the wings, while those from Silver Spangled Hamburg $\delta \times$ Brown Leghorn ϕ had peculiar grayish feathers, showing crescentic pencilling of black and very distinct black spangles at the tip. The daughters then inherited the spangling from the sire's side only. In the F_2 generation all crosses followed the sex-linked mode of inheritance.

These results are in accordance with the hypothesis that in poultry the male is homozygous for sex and the female heterozygous, and that the factors for main characteristics are linked with the factors for sex.

The correlation between body pigmentation and egg production in the domestic fowl, J. A. HARRIS, A. F. BLAKESLEE, and D. E. WARNER (*Genetics*, 2 (1917), No. 1, pp. 36-77, figs. 16).—The authors, in consultation with W. F. Kirkpatrick, have made a minute analysis by means of biometric formulas of data noted (E. S. R., 33, p. 172) on the relationship between body pigmentation and egg production.

The pigment measurements were restricted to the percentage of yellow occurring in the ear lobe of White Leghorns as determined by the color top. The White Leghorns studied were 309 birds entered in the 1913-14 and 375 birds in the 1914-15 International Egg-laying Contest held at Storrs, Conn. The egg records cover a period of one year, November to October, inclusive, of the pullet year. Pigmentation determinations were made in October.

Series of constants for mean fecundity and for variation and correlation in fecundity in the White Leghorn are given. The coefficient of correlation between October ear-lobe color and the egg production of the year was found to be -0.55 . The results for the two years were in close agreement. On the average birds differing by 5 per cent in the amount of yellow in the ear lobe differed by about 7 eggs in their annual production. For example, birds showing only from 10 to 20 per cent of yellow in their ear lobes in October had laid on an average about 185 eggs, whereas birds having from 55 to 65 per cent of yellow had laid an average of about 130 eggs during the year.

The correlation coefficients between October pigmentation and the egg production of each month of the year were negative, and almost without exception these coefficients were significant in comparison with their probable errors. Beginning with a correlation of about -0.15 in November, the intensity of the relationship increased numerically to about -0.25 in December, after which it fell to practically zero in March and April, and then increased in (negative) intensity rapidly to about -0.75 in October.

The hypothesis that the growth of the egg abstracts certain substances (in the present case, yellow pigment) from the body tissue, or precludes its being deposited there, would at once account for the generally higher correlation between measures made at more closely associated periods of time. If this view be the correct one, egg production must be regarded as the (relatively) independent variable, and intensity of pigmentation as the dependent variable. Egg production would then be looked upon as the chief proximate cause of the observed intensity of pigmentation.

One phase of the distribution of egg production in single comb White Leghorns, L. E. CARD (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 3 (1917), No. 5, pp. 39, 40).—The trap nest records of 106 White Leghorn hens at the Connecticut Storrs Station are discussed in their bearing upon the value of first year egg records as a basis for selection for high egg production (E. S. R., 32, p. 73). During the first year (November 1 to October 31) these hens averaged 147 eggs each, the highest record being 255 and the lowest 69 eggs. For the second year the average egg production was 83 per bird, the highest being 162 and the lowest 1 egg. The high producers during the first year continued to be the high producers during the second year.

Chicken rearing at Morden Hall, 1914-15 (*Jour. Bd. Agr. [London]*, 21 (1916), No. 6, pp. 563-576).—Some practical demonstrations in rearing chickens by simple and inexpensive methods are reported. The trials covered several years' experience in the production of about 3,000 chickens each season.

During three years the eggs were bought from different sources and the average of hatching in incubators was only 41 per cent. The following year the eggs were produced at home but with no lessening of the percentage lost in incubation. This was contrary to general experience and attributed to dis-

case in the breeding stock. When such large numbers of eggs are incubated, it is probably more economical to use a composite incubator and a form of brooder more easily inspected and requiring less attention than a number of small ones. The personal factor in chicken raising is emphasized.

In 1913-14, 1,063 birds were fattened, gaining 1.23 lbs. each at a cost in energy value per pound of 8,650 calories. In 1914-15, 1,171 birds gained 0.94 lb. each at a cost of 6,750 calories.

The fattening proved profitable in both years, but attention is called to the fact that it requires skill, and a small holder must decide for himself whether to fatten chickens or sell off the runs.

DAIRY FARMING—DAIRYING.

Economy of production by dairy cows.—A comparison of large and small cows in milk yield, R. I. GRADY (*Mo. Bul. Ohio Sta.*, 2 (1917), No. 10, pp. 334-335).—Data here reported were collected by the station from dairymen in various parts of the State. These dairymen kept accurate records of the amounts of feeds supplied and of the milk produced by each animal. For the sake of accuracy, only the months November to April, inclusive, when the cows were not on pasture, were considered.

It was found that there was a steady and considerable increase in the amount of feed consumed for each pound of milk, solids, and fat produced from month to month as the lactation period advanced. Approximately three times as much feed per unit of product was required in the tenth month as in the first.

Comparing Holsteins and Jerseys, it was noted that when feed alone was considered the Holsteins produced milk more economically throughout the entire lactation period. The Jerseys had a slight advantage in economy of producing solids and a decided advantage in economy of producing fat. On the basis of digestible nutrients consumed, if the Jerseys were considered 100 per cent efficient in producing milk, solids, and fat, the Holsteins were 116.5 per cent efficient in producing milk, 93.4 per cent efficient in producing solids, and 74.5 per cent efficient in producing fat. When the amount of nutrients required for maintenance was deducted from the total amount consumed the Holsteins made a better showing. On this basis, if the Jerseys were considered 100 per cent efficient, the Holsteins were 139.5 per cent efficient in producing milk, 112.1 per cent efficient in producing solids, and 89.2 per cent efficient in producing fat. When production and feed consumption per 1,000 lbs. live weight of the animal were considered, it was found that the Jerseys consumed 19.6 per cent more dry matter and 18.2 per cent more digestible nutrients and produced 1.2 per cent more milk, 25.8 per cent more solids, and 59.3 per cent more fat than the Holsteins.

The effect of open-shed housing as compared with the closed stable for milk cows (*Pennsylvania Sta. Bul.* 147 (1917), pp. 15-17).—Noted from another source (*E. S. R.*, 35, p. 571).

Silage alone compared with silage and mixed hay as roughage for dairy cows (*Pennsylvania Sta. Bul.* 147 (1917), p. 15).—Continuing earlier work (*E. S. R.*, 35, p. 571), cows were fed 1 lb. of grain per 3 lbs. of milk and all the roughage they would consume. During the first year the milk yield decreased 6.14 lb. during the feeding period of 11 weeks when hay and silage were fed, and 1.64 lbs. when silage alone was fed. In this test 45 lbs. silage per head was fed twice daily to both lots and one lot received 5 lbs. hay in addition. When hay was fed in addition to silage, the cows consumed practically the same amount of silage as those fed silage only.

During the second test silage was fed to one lot three times a day. The other lot received silage twice and hay once a day. The lot receiving silage alone consumed an average of 52 lbs. of silage per head per day, while the lot receiving on an average 6 lbs. of mixed hay consumed 36 lbs. of silage. During the second year the yield of cows fed hay and silage decreased 1.94 lbs. per cow during the feeding period of 11 weeks. The decrease for cows fed silage only was 3.3 lbs. per cow.

Care and management of the dairy herd, R. S. HULCK and W. B. NEVEN, (*Illinois Sta. Circ. 204 (1917)*, pp. 5-29, figs. 13).—General directions are given for the care and management of dairy cows, including notes on the age to breed; heifers, care of the herd bull, common diseases of dairy cattle, and the keeping of herd records.

Cow testing associations (*Nebraska Sta. Rpt. 1916*, pp. XI, XII).—Brief mention is made of the work of the four cow testing associations in the State, each of which includes about 25 herds.

In the Gage County association 40 cows were found unprofitable and sold during the first year. Tabulated data show that the 10 best cows in this association made a total profit of \$1,032.88, and the 10 least profitable cows a profit of \$57.82 during the year. The 15 best cows in the association had an average annual production of 8,555.5 lbs. of milk and 365.4 lbs. of milk fat as compared with 3,105.6 lbs. of milk and 129.1 lbs. of fat for the 15 poorest cows.

The average butter production of 800 cows in another association was increased 50 lbs. per cow in three years.

Progress report on the production and distribution of milk, E. MEAD (*California Sta. Circ. 175 (1917)*, pp. 16).—A preliminary report of studies of the economics of production and distribution of milk for the supply of the San Francisco Bay cities. Information given in 36 out of about 100 replies to questionnaires sent to producers in different parts of the State is summarized.

The average yearly production per cow for these 36 dairies is 759 gal. of milk and 223 lbs. of milk fat, as against an average of 500 gal. of milk and 150 lbs. of milk fat for the State. It is noted that the average cost of producing milk increased from 16.4 cts. per gallon in 1916 to 22.7 cts. in July, 1917, while the price received by producers during the same period advanced from 16.4 to 19 cts. per gallon. Among the causes of increased cost of production it was found that the wholesale price of feeds ordinarily used by dairymen increased 38.2 per cent during the above period.

Information is also given regarding cost of distribution, as obtained from 10 distributors in Oakland and Berkeley. The cost of distributing milk by these dealers was 16.53 cts. per gallon, of which 3.78 cts. was due to bad debts, making a total for production and distribution of 39.23 cts. per gallon. "This would seem to show that 40 cts. a gallon was a sufficient price under the conditions existing in June last, and that what was needed was not an increased price to the consumer, but a readjustment of charges between the producer and the distributor."

These data are compared with data on cost of production and distribution of milk in southern and central California. The author discusses the present uneconomical methods of distributing milk and suggests the scope of an inquiry into the means of correcting such methods.

"What is needed in the San Francisco Bay cities is the creation of some expert authority to study whether the present location of our dairying districts makes possible provision of a milk supply as cheaply as it could be furnished from some other district or districts where land is cheaper even if farther removed. . . . The economics of distribution should be studied, not to determine in what direction present distributors have failed, but what could

be saved by a carefully planned distributing system which would eliminate duplication of routes, needless pasteurizing plants, and overhead charges. Nothing will be gained by investigations which stop with criticism of methods and practices of those now engaged in business. Considering the limitations under which they worked, they have done as well as could be expected, and exactly what was expected. The essential thing to be recognized is that leaving this complex problem wholly to private enterprise is an economic mistake which, sooner or later, will have to be corrected."

A report on the milk situation in the Pittsburgh district ([*Pittsburgh, Pa.*: *Penn. Milk Com.*, 1917, pp. 15).—A condensed report is presented of testimony given before the Governors' Tri-State Milk Commission at a public hearing in Pittsburgh, Pa., August 28, 1917, on the production and distribution costs of milk for the Pittsburgh market.

Itemized accounts indicate that for a large number of herds in the Ohio district from which milk is shipped into Pittsburgh the cost of producing milk during 1917 was 3.89 cts. per pound for cows averaging 5,000 lbs. of milk per annum, and 3.24 cts. for those producing 6,000 lbs. of milk. Individual herd records from Pennsylvania show a cost of producing milk during this period varying from 2.16 to 2.67 cts. per pound. Cow-testing association records in five Pennsylvania counties indicate that the cost of producing milk during the period from April 1 to August 1, 1917, varied from 1.99 to 2.74 cts. per pound.

According to the figures given the farmers have been selling milk at a loss, while the distributors made during the six months ended June 30, 1917, a net profit of about 3 per cent on their milk sales. Some of the forces that, singly or combined, tend to fix the price of milk are discussed.

The composition of milk, P. S. ARUP, H. C. HURSH, and H. D. RICHMOND (*Analyst*, 42 (1917), No. 493, pp. 118-124).—Monthly and yearly averages of analyses of 19,317 samples of milk received from farms in 1914, 16,118 samples in 1915, and 14,286 samples in 1916 are tabulated. The yearly average of morning and evening milks and the numerical mean between the two are given in the following table:

Average composition of milk during 1914, 1915, and 1916.

Year.	Morning milk.				Evening milk.				Mean.			
	Sp. gr.	Total solids.	Fat.	Solids-not-fat.	Sp. gr.	Total solids.	Fat.	Solids-not-fat.	Sp. gr.	Total solids.	Fat.	Solids-not-fat.
1914.....	1.0318	12.40	Per ct. 3.59	Per ct. 8.81	1.0316	12.64	Per ct. 3.84	Per ct. 8.80	1.0317	12.52	Per ct. 3.72	Per ct. 8.80
1915.....	1.0319	12.53	3.67	8.86	1.0318	12.71	3.85	8.96	1.0319	12.62	3.76	8.96
1916.....	1.0319	12.55	3.70	8.85	1.0317	12.79	3.94	8.85	1.0318	12.67	3.82	8.85

In 1914 the minimum fat production occurred in May, and appreciable numbers of samples falling below 3 per cent were noted in the morning milks from February to August, inclusive. In 1915 and 1916 the minimum occurred in June, and appreciable numbers of samples falling below 3 per cent occurred in the morning milks from April to July, inclusive. In the three years the highest percentage of fat occurred in November. The percentage of solids-not-fat was low in July and August and normal in September. A decreasing difference between the morning and evening percentages of fat is noted and discussed.

Principles and practice of milk hygiene. L. A. KLEIN (*Philadelphia and London: J. B. Lippincott Co., 1917, pp. X+329, pls. 5, figs. 33*).—This book, which is intended primarily for a text for students in milk hygiene, treats of the physiology of milk secretion; the properties of colostrum and its detection; the physical and chemical properties of milk, its microscopic appearance, the ferments and enzymes it contains, and the bacteria with which it may be contaminated; defects in the consistency, odor, taste, and color of milk due to nonbacterial causes; diseases of cattle transmissible to man through milk, or which may make milk harmful to man, and diseases of man transmissible through milk; dairy inspection; pasteurization; and methods of examining milk. The appendix gives methods and standards for the production and distribution of certified milk.

Safe milk.—An important food problem, E. A. SWEET (*Pub. Health Rpts. [U. S.], Sup. 31 (1917), pp. 24*).—A general discussion of the production and handling of sanitary milk, the topics dealt with being the composition of milk, abnormal qualities of milk, milk adulteration, accidental impurities, bacteria in milk, and milk-borne diseases and their prevention.

Report of an investigation into the hygienic quality of the milk supplied to babies attending certain schools for mothers, with suggestions to those responsible for the feeding of children. W. BUCKLEY (*Nat. Clean Milk Soc. [London], [Pub.], No. 10 (1917), pp. 18*).—Results are given of the examination of samples of milk from 27 dairymen in London supplying milk for bottle-fed babies. The bacterial content of these milk samples varied from 98,000 to 104,800,000 per cubic centimeter. Organisms of the *Bacillus coli* group were present in all the samples examined, and tubercle bacilli were found in two of the samples and in one sample of certified milk.

Suggestions are given for the improvement of the milk supply of cities in Great Britain and Ireland.

Variations in cream tests.—Differences between butter and butter fat. W. A. WILSON (*Saskatchewan Dept. Agr. Bul. 43 (1916), pp. 15, figs. 2*).—This bulletin gives information concerning the variation of the cream test and the difference between butter and milk fat.

In seven tests, in each of which mixed milk was divided into three lots and separated at temperatures of 98, 80, and 70° F., all other conditions being uniform, the fat content of the cream increased as the temperature of the milk was decreased. In one of the tests 24 per cent cream was separated from milk at a temperature of 98° and 35 per cent cream at a temperature of 70°. The fat content of the skim milk was higher for the cooler lots of milk.

Six lots of milk were separated at speeds of the separator crank varying from 50 to 62 revolutions per minute, the separators being adjusted to a correct speed of 60 revolutions per minute. In these tests the fat content of the cream decreased with the speed of the separator. In one trial the test dropped from 41 to 22 per cent when the crank speed was reduced from 60 to 50 revolutions per minute.

In another series of seven trials cream tests ran from 1 to 5 per cent higher when the receiving can of the separator was almost empty than when the receiving can was full. Other causes for variation in cream tests are mentioned.

In order to demonstrate how the weight of butter churned can be increased when quality is not considered, a series of five churnings was made, in each of which one lot of cream was divided into two parts of equal weight and churned under different conditions. In one test 26 lbs. of 41 per cent cream, at a temperature of 55°, was churned in 25 minutes and made 8 lbs. 2 oz. of butter and 17 lbs. 4 oz. of buttermilk which tested 0.15 per cent fat. The other lot of

26 lbs. of this cream, at a temperature of 60°, was churned in 15 minutes and made 9 lbs. 2 oz. of butter and 16 lbs. of buttermilk testing 0.3 per cent fat.

Acidity and butter, I. F. W. BOUSKA (*N. Y. Produce Rev. and Amer. Cream.*, 1917, No. 23, pp. 890, 892).—A discussion of the relation of acidity of cream to quality of butter, together with detailed information as to the methods employed by creameries in neutralizing cream with limewater and sodium carbonate.

Butter makers' short course, Mr. and Mrs. W. J. McLAUGHLIN (*Owatonna, Minn.: Authors, 1917*, pp. 168, figs. 36).—This is a manual of information on creamery butter making and creamery operation, based for the most part on the experience of the authors.

An ice cream laboratory guide, W. W. FISK and H. B. ELLENBERGER (*New York: Orange Judd Co., 1917*, pp. IV+92).—This is a brief outline of laboratory exercises prepared for the purpose of helping students apply the scientific principles of ice cream manufacture.

Third annual report of the creamery license division for the year ended March 31, 1917, R. E. CALDWELL, T. H. BROUGHTON, and S. L. ANDERSON (*Indiana Sta. Circ. 63 (1917)*, pp. 3-44, figs. 4).—A report of the activities of the creamery license division of the station during the year, including lists of licensed testers and dairy products manufacturing plants in the State and rules governing the enforcement of State creamery license law.

Dairy division, D. CUDDIE (*Ann. Rpt. Dept. Agr., Indus. and Com., New Zealand, 1917*, pp. 30-38).—This is a review of the dairy industry of New Zealand for the year ended March 31, 1917, including statistics on butter and cheese grading and exportation.

VETERINARY MEDICINE.

[Report of the] department of veterinary science, J. B. PAIGE (*Massachusetts Sta. Rpt. 1916*, pp. 89a-92a).—Experiments in the prevention of hog cholera were conducted in a herd of from 75 to 150 hogs that were fed upon garbage from a source which on two previous occasions had caused outbreaks of hog cholera. A part of the herd in which an artificial immunity had not been established by means of serum and virus was treated by the simultaneous method, the Globulin preparation of serum being used, and another lot was treated with a refined Amber Serum. The Globulin preparation showed an advantage over the usual antihog-cholera serum and the refined Amber Serum gave very satisfactory results.

The status of the work with *Bacterium pullorum* relating to the specificity of its antibodies, with special reference to the agglutinins; to toxins elaborated and their relation to specific conditions in adult birds; and to the production of antibodies, with special reference to potency and rate of production, is briefly reported upon. The investigations have shown that the toxin is endotoxic and that it is most intimately connected with the bacterial cell.

The suppression and eradication work with bacillary white diarrhea in fowls shows the agglutination test to be most accurate and reliable. The disease has been completely stamped out in the flocks that have been tested during the past two years and in which the directions for the handling of the flocks have been carried out. Of the 14,851 birds tested, owned by 78 different parties in 57 different towns scattered throughout the State, only 2,207 gave positive reaction.

Fourteenth annual report of the Minnesota State Live Stock Sanitary Board for the year ended July 31, 1917, S. H. WARD (*Ann. Rpt. Minn. Live Stock Sanit. Bd., 14 (1917)*, pp. 18).—The occurrence of and work with the more important infectious diseases of live stock are reported.

The advantages of testing pure-bred herds for tuberculosis are discussed. Eradication work with tuberculosis was actively carried on, especially among the pure-bred herds of cattle. Almost one-half of the tuberculous pure-bred cattle which were slaughtered during the year were found to have been imported with a certificate of health or as calves. With the view to protecting buyers a regulation was adopted requiring all imported pure-bred cattle to enter quarantine at destination, pending a retest within 60 days, unless the cattle were from accredited tuberculosis-free herds. The plan of listing tuberculosis-free herds has resulted in placing over 80 pure-bred herds on the list. During the year 61,727 cattle were tuberculin tested of which 1,335 reacted, almost all of which have been appraised and slaughtered.

Annual report for 1916 of the principal of The Royal Veterinary College, J. McFADYEAN (*Jour. Roy. Agr. Soc. England*, 77 (1916), pp. 197-206, figs. 2).—This report, which deals with the occurrence of infectious diseases of live stock, includes tabular data showing the outbreaks for the years 1911 to 1916, inclusive, of anthrax, glanders, sheep scab, and hog cholera. A brief summary is given of investigations made of John's disease, more extended reports of which have been noted from other sources (*E. S. R.*, 36, p. 382; 37, p. 479).

Live stock sanitary laws of Montana; also rules and regulations and orders of the Montana Live Stock Sanitary Board (*Helena, Mont.: State*, 1917, pp. 136).—"The rules and regulations of the Montana Live Stock Sanitary Board conform as closely as possible to the rules and regulations of the Bureau of Animal Industry of the U. S. Department of Agriculture. . . . All proclamations and orders heretofore promulgated but not contained in this pamphlet have been rescinded."

Quarantine and general regulations of State of New Mexico (*Albuquerque, N. Mex.: Cattle Sanit. Bd.*, 1917, pp. 8).—This gives the regulations of New Mexico governing admission, transportation, and inspection of cattle, horses, mules, asses, hogs, and birds, effective July 1, 1917.

Iron as an antidote to cottonseed meal injury, W. A. WITHERS and F. E. CARRUTH (*Jour. Biol. Chem.*, 32 (1917), No. 2, pp. 245-257, figs. 4).—"Four feeding experiments with pigs have shown that iron salts have a decidedly beneficial action in preventing cottonseed meal injury. Much larger quantities of meal are consumed, deaths have been postponed or averted, and better gains have been made when an iron salt is added to the feed.

"Wood ashes apparently have no antidotal action in averting death, but as the lot receiving ashes made much better gains it is possible that this is due to improvement of the inorganic part of the diet composed of corn and cottonseed meal.

"The suggestion is made that the iron salts combine with, or facilitate oxidation of, the harmful substances in cottonseed meal. Iron salts have an antidotal action toward cottonseed meal poisoning of rabbits and swine.

"By thus controlling the toxic factor, it is shown that cottonseed meal injury is not due to a lack of 'vitamins' or to deficiencies in calcium, sodium, and chlorin, which ash analyses might lead one to suspect as the limiting mineral factors in a diet of cottonseed meal and corn."

Investigations on the prevention of nuisances arising from flies and putrefaction, F. W. FOREMAN and G. S. GRAHAM-SMITH (*Jour. Hyg. [Cambridge]*, 16 (1917), No. 2, pp. 109-226, pls. 5, figs. 7).—In the first part of this paper the authors summarize the preliminary experiments and observations which led them to consider that coal-tar creosote oil, alone or combined with other reagents, would prove of great value in the prevention of putrefaction in exposed bodies, the deodorization of putrefying carcasses, the destruction of fly maggots in animal refuse and manure, and the prevention of nuisances caused

by flies. In the second part the results of their investigations in regard to certain phenomena, such as the production of gas and odors, the exudation of fluid, and chemical changes in the tissues, which precede or accompany the disintegration of the principal constituents of the body under various conditions, are recorded. In part 3 are considered the actions of various coal-tar oils and their constituents on maggots and the results of treating carcasses of small and moderate-sized animals in the open. Part 4 records the results of the use of creosote oil mixtures.

Pathologic conditions noted in laboratory animals. F. C. MANN and S. D. PRIMHALL (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 2, pp. 195-204, figs. 9).—The autopsical findings of a number of laboratory animals used for experimental purposes are reported. The desirability of using only normal animals for experimental purposes and the importance of comparative pathology in experimental work is noted.

The treatment of infected wounds, A. CARREL and G. DEHELLEY (*Le Traitement des Plaies Infectées*. Paris: Masson & Co., 1917, pp. 179, pls. 6, figs. 76).—An explanation of Carrel's method of treating wounds in which Dakin's hypochlorite solution is used.

The treatment of infected wounds, A. CARREL and G. DEHELLEY, trans. by H. CHILDE (London: Baillière, Tindall & Cox, 1917, pp. 1X+238, pls. 6, figs. 76; see in *Vet. Jour.*, 73 (1917), No. 506, pp. 300, 301; *Jour. Amer. Med. Assoc.*, 69 (1917), No. 19, p. 1645).—An English translation of the above noted work.

The antiseptics and the war, L. GERSHENFELD (*Amer. Jour. Pharm.*, 89 (1917), No. 11, pp. 487-496).—A discussion of the newer antiseptics that have been used in the treatment of wounds.

Report on the use of Dakin's solution, H. E. KINGMAN (*Jour. Amer. Vet. Med. Assoc.*, 52 (1917), No. 2, pp. 185-188).—The results of the use of Dakin's solution in 13 cases are reported. The technique of Dufresne (Daufresne) as described by Eakins (E. S. R., 37, p. 477) was used in all the cases.

The results indicate that in reasonably fresh wounds such as wire cuts and other accidental wounds serious infection can be controlled and the time of healing materially shortened. The solution has also been found satisfactory for use on the arms and hands and external surfaces in obstetrical operations and the removal of secundines. It has also been used as a first step in the preparation of the hands and the fields of operation.

The preparation of vaccines on a large scale, J. CUNNINGHAM, H. C. BROWN, and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 5 (1917), No. 1, pp. 1-18, pls. 14).—This is a general description and discussion of the preparation of vaccines at the Central Research Institute in India.

Toxicity of certain preservatives used in serums, viruses, and vaccines, J. P. LEAKE and H. B. CORBITT (*Pub. Health Serv. U. S., Hyg. Lab. Bul.* 110 (1917), pp. 35-45, figs. 2).—From the results of the study reported there appears to be no definite minimum lethal dose of the disinfectants studied (phenol, tricresol, various commercial cresols, and glycerin), since some of the experimental animals survived doses twice the size of those which killed a considerable proportion. Considering, however, the minimum lethal dose to be the amount necessary to kill 80 per cent of the animals on a given dose, phenol was found to have a minimum lethal dose of 0.00037 gm. per gram weight of mouse. The tricresol was found to have the same value as phenol, and the toxicity of ether was found not to be lessened when they were diluted with normal horse serum. The toxicity of glycerin, calculated on the same basis, was found to be approximately 0.012 gm. per gram weight of mouse. The toxicity of glycerin mixed with phenol or cresol was found to be slightly higher than that of pure glycerin.

The results indicate that in determining the toxicity coefficient of coal-tar disinfectants at least five mice should be used on each dose. Male mice were roughly 20 per cent more susceptible to the coal-tar disinfectants than females.

The transmission of antibodies (agglutinins and complement-fixing) from mother to fetus in utero, I. F. HUDDLESON (*Cornell Vet.*, 7 (1917), No. 4, pp. 284-291).—The investigation reported deals with a comparison of the blood reaction of aborted fetuses and their respective dams, pregnant cows and their fetuses, and new-born calves and their respective dams. The technique used in the study was that previously described by the author (*E. S. R.*, 37, p. 79).

The results show that there is no relation between the bacterial antibodies produced in the blood of the dam and that of the aborted fetus, fetuses taken from pregnant cows, and new-born calves. It appears that the agglutinins and complement-fixing bodies are not transmitted from mother to fetus in utero. "If there is a resistance to an infection conferred to the offspring born of an immune mother, this resistance can not be detected by means of the agglutination and complement-fixation tests when applied to the blood of the offspring."

Differentiation of the paratyphoid-enteritidis group, II, E. O. JORDAN and RUTH VICTORSON (*Jour. Infect. Diseases*, 21 (1917), No. 6, pp. 554, 555).—In continuation of the work previously noted (*E. S. R.*, 37, p. 275) the authors find that in lead acetate agar "all typical paratyphoid A strains fail to blacken the medium in from 18 to 24 hours. All strains of *B. enteritidis* give a positive reaction. The great majority of *B. paratyphosus* B strains give a consistently positive reaction while all *B. suispestifer* strains are negative. Five strains of porcine origin, belonging to the *B. paratyphosus* B type, are not constant in their reactions, but these are the same strains that in the [senior author's] earlier study have been found variable and irregular in other respects."

Conglutination test for the diagnosis of glanders, H. W. SCHOENING (*U. S. Dept. Agr., Jour. Agr. Research*, 11 (1917), No. 3, pp. 65-75).—The author briefly reviews the literature and describes the technique of the conglutination test, as used in the work reported, in detail. The technique used was similar to that reported by Pfeller and Weber.¹

In a comparative study of 341 samples of horse serum, 137 were positive, 190 negative, and 14 doubtful, to the complement fixation test; while 150 were positive, 182 negative, and 9 doubtful, to the conglutination test. Post-mortem data were not obtained from all the cases, but those samples in which positive results were obtained to both tests were, in the majority of cases, from animals which yielded a positive or suspicious reaction to the ophthalmic mallein test or were undoubtedly affected with glanders.

Of 115 samples of mule serum, 32 reacted positively, 63 negatively, and 20 were doubtful, to the complement fixation test; while 51 were positive, 63 negative, and 1 doubtful, to the conglutination test.

The conglutination test for glanders is considered a specific complement deviation reaction. Since the test is more sensitive than complement fixation, absolute accuracy in the technique, both qualitatively and quantitatively, is necessary to obtain reliable results. The test is considered to be superior to the complement-fixation test for the testing of mule sera and horse sera possessing nonspecific complement-fixing bodies. Since no single test is infallible, the conglutination test should be used in conjunction with the complement fixation and agglutination tests.

The summarized data are submitted in tabular form.

The glycerin bouillon reaction curve of tubercle bacilli as recorded by the Bovie potentiometer, L. FROTHINGHAM (*Jour. Med. Research*, 37 (1917), No. 4

¹ Mitt. Kaiser Wilhelms Inst. Landw. Bromberg, 5 (1913), No. 4, pp. 255-262.

pp. 262-275, pls. 3, figs. 2).—The author concludes that for practical purposes, having in mind only an aid to the identification of types of tubercle bacilli, the value of the potentiometer test is not commensurate with the cost of the equipment or with the amount of work and time required to complete a test.

The reactions to human and bovine tuberculin applied by the method of von Pirquet in cases of tuberculous disease of the bones and joints. H. J. JORDAN (*Lancet* [London], 1917, II, No. 14, pp. 519-521).—The results of the investigation reported showed that local reactions to inoculations of both the human and bovine tuberculin were invariably present in all cases from which tubercle bacilli had been isolated from the pus. The reaction, although invariably present, varied within wide limits as regards degree. Weakly and tubercle patients usually reacted feebly, while the strong and vigorous patients exhibited wide differences in the degree of their reactions. The quantitative von Pirquet test was found to be of no value in forming an estimate of the severity of the infection and was of little prognostic value. The type of tubercle bacillus with which the patient was infected could not be ascertained by the nature of the reaction to the tuberculin employed.

The susceptibility of Indian milch cattle to tuberculosis. W. G. LISTON and M. B. SOPARKAR (*Indian Jour. Med. Research*, 5 (1917), No. 1, pp. 19-71, pls. 21, figs. 22).—The object of the experiments reported was to ascertain the extent to which Indian cattle, which are seldom found to suffer from natural tuberculosis, are susceptible to the action of the bovine tubercle bacillus when injected subcutaneously in large and small doses and to compare the results obtained with the effect of similar doses on English cattle. The experimental live and post-mortem findings, together with charts illustrating the comparative progressive weight and the extent of the tuberculous lesions in the experimental animals, are submitted.

The experiments showed that at least 50 per cent of Indian buffalo or cow calves lived for many days after inoculation with 50 mg. of a bovine tubercle bacillus culture, and when killed exhibited only retrogressive or healing tubercular lesions. The results are indicated as confirming the general experience that Indian cattle are less commonly affected by tuberculosis than English cattle, and that "the comparative infrequency of the disease among cattle in India is due to a natural resistance rather than to any method of breeding or keeping cattle in India as compared with England." A considerable variation in susceptibility was, however, observed in the Indian calves as compared with English calves. "Whether this variation be associated with differences in the breeds of the calves used by us has not yet been determined. It, however, follows that the comparative rarity of tuberculosis in Indian cattle must in part at least be attributed to diminished opportunities for acquiring infection."

The danger of the existence of tuberculosis in imported cattle and the necessity of attention to this point when attempting to develop a more useful milk-yielding stock is noted.

The experiments reported also show that, when using Indian breeds of cattle, the test for distinguishing between tubercle bacilli of the bovine and human types by using 50 mg. of a culture of the bovine type of bacillus can not be relied upon. In 50 per cent of the animals used the effects produced by such inoculation did not materially differ from the effects produced by the inoculation of a similar dose of tubercle bacilli of the human type in English cattle.

The experiments also incidentally throw some light on the practical absence of tuberculous lesions caused by the bovine type of bacillus in children and

adults in India. It is indicated that this material will be discussed in a subsequent publication.

Bovine tuberculosis, J. F. DEVINE (*Chicago: Amer. Vet. Pub. Co., 1917, pp. 120, figs. 7*).—This volume discusses the various phases of the disease. It contains an introductory article by E. Z. Russell, a discussion of the intradermal tuberculin test by D. F. Luckey, and an article on the State accredited herds by O. E. Dyson.

Advantages of testing pure-bred herds, S. H. WARD (*Jour. Amer. Vet. Med. Assoc., 52 (1917), No. 2, pp. 156-160*).—The author points out and briefly discusses the advantages of testing pure-bred herds.

The sterility of cows, its causes and treatment, J. ALBRECHTSEN, trans. by H. WEHRBEIN (*Chicago: Alexander Eger, 1917, pp. 98 figs. 27*).—An English translation of the work previously noted (*E. S. R., 24, p. 389*). See also a recent note (*E. S. R., 37, p. 379*).

Facts disclosed in a study of the presence of *Bacillus abortus* in milk by means of the agglutination test, L. H. COOLEGE (*Jour. Med. Research, 5 (1917), No. 2, pp. 207-214, figs. 2*).—The author here reports upon investigations at the Michigan Agricultural College conducted in continuation of those previously noted (*E. S. R., 36, pp. 277, 383, 480*).

Examinations made of the milk from 112 cows on 7 farms resulted in the finding of that from 24 cows on 5 farms to be infected with *B. abortus*. The percentage of infected udders in the 5 herds varied from 15 to 100 and was 27 per cent of the total. "The infection was present in a high percentage of the animals or was entirely absent, indicating the very infectious nature of the disease. Once the infection is established in the udder the milk becomes a carrier of *B. abortus* and a possible source of the infection for years. In no instance has the udder infection died out after being firmly established during the three years that observations have been made. The rear quarters are the first to show *B. abortus* infection, indicating that the genital discharges and switching of the tail are its source. The infection may then be carried to the front quarters upon the hands. The age of the cow apparently has no connection with the first appearance of the infection."

A list of 11 references to the literature is included.

Formalin treatment in mastitis, J. K. BOSSHART (*Jour. Amer. Vet. Med. Assoc., 51 (1917), No. 6, p. 831*).—The author reports having obtained good results from the use of formalin in the treatment of mastitis in cattle as recommended by Frost (*E. S. R., 37, p. 277*). Half-ounce doses have, however, been found too toxic for some individuals, and he recommends as a safer dosage the use of 1 teaspoonful or about 0.2 oz. in 0.5 pint of raw linseed oil twice or three times daily, alternated with 1 oz. of turpentine in oil.

The cattle tick in Australia, J. D. STEWART ET AL. (*Advisory Council Sci. and Indus., Aust., Bul. 1 (1917), pp. 30, pls. 4*).—This is a report of a special committee appointed to review the status of the tick pest in Australia, present and future, and to make recommendations as to future research and immediate remedial or preventive measures, whether by legislation or otherwise.

The committee reports that there is no reason to believe that the cattle tick will not establish itself in congenial portions of the coastal areas in any part of Australia and Tasmania, and that unless its spread is checked it will be only a matter of time before all the States of the Commonwealth will become infested. At the present time the infestation is chiefly in Queensland and the Northern Territory, and to a less extent in Western Australia and New South Wales. As the matter is of national importance and vital to the prosperity of the Commonwealth, it is recommended that the Federal Government undertake the work of eradicating the pest. It is suggested that a start be made in the

east with the North Coast area in New South Wales and the adjacent portions of southern Queensland, and in the Helidon-Withcott area which adjoins the Darling Downs in Queensland. Other suitable areas are to be found in Queensland, the Northern Territory, and Western Australia from which a further selection might be made.

Hog cholera prevention and the serum treatment, P. T. PETERSEN (*California Sta. Circ.* 176 (1917), pp. 15, figs. 5).—A brief discussion of the subject.

Rinderpest in swine.—The first report of the **Ako Antirinderpest Serum Institute**, H. TAKASAWA (*Jour. Formosa Vet. Assoc.*, No. 1 (1916); *abs. in Abs. Jap. J.* 1 (1917), No. 4, pp. 313-315).—During the 1911-12 epidemic of rinderpest 54 per cent of the animals which had not received protective inoculation were affected, whereas in the same locality where the plague was most severe only 1 per cent of the inoculated animals were infected.

Epidemics and their control during war, H. MIESSNER, trans. by A. A. LEIBOLD (*Chicago: Amer. Vet. Pub. Co., 1917, pp. 215, figs. 371*).—An English translation of the author's *Kriegstierseuchen und ihre Bekämpfung*, which is a guide for army, Government, and practicing veterinarians.

Part 1 (pp. 13-28) relates to horse hospitals and horse depots, blood examination stations, and disinfection. The diseases treated in part 2 (pp. 29-194) are glanders, anthrax, rabies, mange, contagious pleuropneumonia of horses (*influenza pectoralis*) catarrhal influenza, strangles, dourine, contagious pleuropneumonia of cattle, and rinderpest. Hints on handling war horses in America, by A. A. Leibold, are given in an appendix (pp. 197-207).

Kumri, combined diffuse sclerosis and central poliomyelitis of horses, G. H. K. MACALISTER (*Mem. Dept. Agr. India, Vet. Ser., 2* (1917), No. 8, pp. 263-267, pls. 6).—"Kumri is a paraplegic disease of horses, associated with a diffuse sclerosis of the white matter of the spinal cord, affecting principally the propriospinal tracts and to a lesser extent the fibers of the lateral efferent and posterior efferent tracts. No causal microorganism has been isolated from cases of kumri. Filariasis and kumri are often coincident, but this is to be regarded as a chance conjunction and not as implying a causal relationship. This applies also to other types of helminthiasis.

"It is possible that kumri may be due to some type of vegetable poisoning or mold intoxication. In the present state of knowledge, this is no more than a speculation, which future research may establish or demolish.

"The disease occurs most commonly in low-lying districts subject to inundation and is favored by warm moist climates. These conditions play some part in the production of kumri, either as a predisposing agency, or primarily as the direct causus morificans. That it is the primary cause of the disease can only be established by the exclusion of all other possible causes. The condition is incurable but general treatment may possibly arrest the degenerative processes in those nerve elements, where these changes have not reached the stage of complete disorganization.

"Until the nature of the causal agent is known, no specific preventive measures can be suggested, but ordinary general hygienic precautions may be followed with advantage."

[Poultry sanitation], J. C. GRAHAM and H. D. GOODALE (*Massachusetts Sta. Rpt.* 1916, pp. 87a, 88a).—An experiment in the rearing of young poultry isolated on a plat half a mile from the poultry plant, where they were cared for by a man who had no other duties, resulted in an apparent freedom from disease and a remarkable freedom from the larger common parasites of poultry and in a low rate of mortality.

Tuberculosis of poultry in Ontario. D. H. JONES (*Ontario Dept. Agr. Bul.* 255 (1917), pp. 8, figs. 6).—This is a general discussion of the subject relative to cause, nature, symptoms, and control and eradication of the disease.

RURAL ENGINEERING.

Seepage and return waters. L. G. CARPENTER (*Colorado Sta. Bul.* 180 (1911), pls. 1, pp. 3-70, pls. 2; 2, pp. 3-45; 3, pp. 3-146).—This bulletin, issued in 1912, consists of three parts, of which part 2 was published in separate form in 1911 (*E. S. R.*, 28, p. 83).

Part 3 gives data of measurements and observations relative to seepage and return waters from irrigation for the Big Thompson River, Little Thompson Creek, St. Vrain Creek, Left Hand Creek, Boulder Creek, South Boulder Creek, Dry Creek, Clear Creek, Bear Creek, South Platte River, Arkansas River, the Rio Grande, Conejos River, and Uncompahgre River.

Part 1 summarizes the deductions from the observations in parts 2 and 3 and discusses the phenomena of seepage and the laws of flow of underground water as they apply to such conditions.

Report of Water Rights Branch of the Department of Lands for the year ended December 31, 1916. W. YOUNG (*Rpt. Water Rights Branch Dept. Lands, Brit. Columbia*, 1916, pp. 48, figs. 5).—This report is of an administrative nature and contains data on irrigation, precipitation, and water conservation in the Province of British Columbia for the year ended December 31, 1916.

Calculations for design of irrigation structures. C. W. HELMICK (*Trans. Univ. Iowa*, 1917, June; *abs. in Engin. and Contract.*, 48 (1917), No. 6, pp. 121-124, figs. 3).—Formulas of flow for use in calculating discharge through high gates of irrigation canals are given.

Farm drainage methods. W. W. WEIR (*California Sta. Circ.* 174 (1917), pp. 31, figs. 21).—This circular was prepared under a cooperative agreement with the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. It is intended for use only in sections of California which are free from alkali and is not considered applicable to irrigated land.

"The purposes of this circular are to call attention to the need for drainage on many of the California farms which are located in regions where the annual rainfall is sufficient for agricultural purposes; to outline the advantages to be derived from drainage; to recommend the use of tile and the systematic construction of open drains; to offer suggestions regarding the spacing, depth, and size of drains, as well as methods and cost of installing them; and to urge better cooperation between the owners of adjoining farms in the disposal of storm water and surface run-off."

Drainage. B. H. LANDELS (*Nova Scotia Dept. Agr. Bul.* 7 (1915), pp. 34, figs. 13).—This is a brief discussion of the principles of land drainage and the construction of land drainage systems with reference to their application to Nova Scotia conditions.

The disinfection of drinking water. H. D. DAKIN and E. K. DUNHAM (*Brit. Med. Jour.*, No. 2948 (1917), pp. 682-684; *abs. in Jour. Soc. Chem. Indust.*, 6 (1917), No. 11, pp. 610, 611).—Experiments with parasulphondichloraminobenzene acid as a means for the effective sterilization of small drinking-water supplies, especially for field use, are reported. It was found to be more suitable than chloramin-T or toluensulphondichloramin.

A concentration of 1:300,000 was found sufficient to sterilize any ordinary heavily contaminated water in about 30 minutes. Such a concentration could be relied upon to remove coli, typhoid, or cholera organisms. Special experiments showed that the substance in tablet form was effective when acting on

water contained in aluminum bottles. "One point of advantage possessed by the present disinfectant over most hypochlorite preparations is the fact that the active chlorine is less rapidly used up, so that the process of disinfection continues for a longer period."

Information on the preparation, properties, and cost of the disinfectant are also given. "It is safe to say that the tablets could be sold at such a price that a gallon of water could be sterilized at a cost of one penny."

Experimental roads in the vicinity of Washington, D. C., B. A. ANDERTON and J. T. PAULS (*U. S. Dept. Agr., Office Sec. Circ. 77 (1917), pp. 8*).—This circular summarizes data on methods of construction, maintenance, and up-to-date cost records on experimental sections of surface treated macadam and gravel, bituminous macadam, bituminous concrete, cement concrete, and brick used in and near Washington, D. C. Traffic census data on most of the experimental sections are also given.

Massachusetts Highway Commission curve tables, compiled by A. M. LOUIS (*New York: John Wiley & Sons, Inc., 1917, pp. 47, figs. 2*).—Tables furnished by the Massachusetts Highway Commission for externals, radii, arcs for tangents of 100 ft., deflections for arcs of 100 ft., and skew distances for widths of 100 ft. are given.

Report of [Illinois] State Highway Commission, 1915-16 (*Ill. Highway Dept. Rpt., 1915-16, pp. 59, figs. 16*).—This is a review of the work of the Illinois State Highway Commission for 1915 and 1916.

General specifications for materials (*Ohio Highway Dept., Specifica., No. 3 (1915), pp. 77, figs. 9*).—General specifications for road-building materials issued by the Ohio Highway Department are given.

Material specifications (*Ohio Highway Dept., Specifica., No. 4 (1915), pp. 77, fig. 9*).—Specifications issued by the Ohio Highway Department for Portland cement, block, paving brick, stone and slag, gravel and sand, nonbituminous and bituminous binders and materials, timber, linseed oil and paint, steel and iron, and pipe are given. An appendix outlines methods of testing these materials.

The influence of total width on the effective width of reinforced concrete slabs subjected to central concentrated loading, A. T. GOLDBECK (*Proc. Amer. Concrete Inst., 13 (1917), pp. 78-88, figs. 13*).—Tests conducted by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture are reported to show how the effective width of a reinforced concrete slab depends on the total width of the slab when it is supported at two ends only and is subjected to a central concentrated load.

It was found that "as the width of slab increases the ratio of effective width to span length shows considerable variation. This variation, however, is representative of what might be expected in actual structures, and apparently does not follow any law so far as thickness is concerned." The relation is expressed in the following table:

Relation of total width to effective width.

Total width.	Effective width.	Total width.	Effective width.	Total width.	Effective width.	Total width.	Effective width.
Span.	Span.	Span.	Span.	Span.	Span.	Span.	Span.
6.1	0.10	0.6	0.50	1.1	0.67	1.6	0.72
.2	.20	.7	.65	1.2	.70	1.7	.72
.3	.28	.8	.68	1.3	.71	1.8	.72
.4	.37	.9	.72	1.4	.71	1.9	.72
.5	.44	1.0	.75	1.5	.72	2.0	.72

"The design of a slab of any width can be accomplished by using the formulas for narrow rectangular beams and substituting for the breadth (b) the value obtained from the above table."

The flow of concrete under sustained loads, E. B. SMITH (*Proc. Amer. Concrete Inst.*, 13 (1917), pp. 99-102, figs. 2).—Experiments conducted by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture on the flow of concrete in cylinders and beams under load are reported.

It was found that "the law of the flow of concrete is asymptotic. The flow continues at a gradually decreasing rate and yet is an appreciable amount during three to four weeks. It then continues more slowly for an indefinite period, but this additional change is very small.

"The natural total shrinkage of dry concrete is about 0.05 per cent in three months. The total net flow under load, exclusive of natural shrinkage, may be as great as 0.15 per cent, depending upon the time, material, and load. The total combined effects of shrinkage and flow in compression may amount to as much as 0.2 per cent. This would give, in a 20-ft. column not reinforced, if loaded to about 800 lbs. per square inch, nearly 0.5 in. of deformation; and may produce, in a reinforced beam of 20-ft. span fully loaded, a sag of nearly 0.3 in. Even the much smaller deformations, which are inevitable, may produce, if not anticipated and provided for, serious results in the setting of apparatus and machinery, and in the alignment of shafting, and may easily cause other parts and members of the structure to be overloaded.

"The effect of flow within the material itself is either to relieve the stress condition, if the construction and loading make this possible, or to gradually change the length or position of the member.

"The maximum amount of flow or the flow for any particular period is almost directly proportional to the magnitude of the stress up to 1,000 lbs. per square inch. It is, therefore, only necessary to decide upon the allowable flow deformations in designs before determining the allowable dead- and live-load stresses.

"The measurement of stress conditions in concrete structures can not be made directly by deformation readings, unless all the flow constants as to time, material, and loading are known. . . . Deformation readings taken only a short time apart will indicate apparently different stress values.

"The magnitude of the flow deformations vary quite largely with the kind of aggregate and the mixture. . . . It is shown in these experiments that gravel concrete has about 20 per cent more deformation than limestone concrete.

"The modulus of elasticity of concrete is different for each mixture and for each different aggregate. It changes and decreases in value with time and as the flow deformations increase. If the modulus of elasticity could be ascertained for any particular concrete with due respect to the time factor, stress values could then be determined by simple deformation readings.

"In the case of a reinforced beam, the effect of flow in the concrete is to lower the position of the neutral axis, thus enlarging the compressive cross-sectional area and relieving the unit stress value. More stress is also thrown into the steel."

Friction tests of concrete on various sub-bases, A. T. GOLDBECK (*Proc. Amer. Concrete Inst.*, 13 (1917), pp. 239-245, figs. 2; *Good Roads*, 51 (1917), No. 15, pp. 229-231, figs. 2).—Further experiments (E. S. R., 37, p. 88) are reported in which the ground was muddy following a thaw. The results are given in the following table:

Frictional resistance of concrete on various sub-bases (sub-bases thoroughly saturated with water and surrounding ground exceedingly soft; weight of specimen, 550 lbs.).

	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.	Movement.	Force.	Coefficient.
Gravel	0.001	120	0.14	0.01	300	0.35	0.05	500	0.58	1.500	950	1.69
Gravel	.001	200	.23	.01	460	.53	.05	630	.71	1.400	925	1.05
Gravel	.001	150	.17	.01	250	.30	.05	410	.47	.750	925	1.05
Gravel	.001	140	.16	.01	280	.32	.05	400	.46	.750	875	1.00
Gravel	.001	510	.58	.01	640	.73	.05	950	1.10	.500	1,050	1.20
Gravel	.001	400	.46	.01	660	.76	.05	940	1.08	2.000	1,160	1.33
Gravel	.001	240	.28	.01	630	.73	.05	900	1.04	.875	1,625	1.87
Gravel	.001	150	.17	.01	410	.47	.05	850	.98	1.250	1,425	1.64
Gravel	.001	140	.16	.01	410	.47	.05	710	.82	1.750	1,260	1.45
Gravel	.000	2,500+	2.9+	.00	2,500+	2.9+	.00	2,500+	2.9+	.000	2,500+	2.9+
Gravel	.001	180	.21	.01	280	.32	.05	480	.55	.375	800	.92
Gravel	.000	2,500+	2.9+	.00	2,500+	2.9+	.00	2,500+	2.9+	.000	2,500+	2.9+

These results, when compared with the previous results, "show very clearly that much depends upon the moisture condition of the sub-base. A wet sub-base permits the concrete to slide very much easier than does a dry sub-base. This apparently also applies to the specimens mounted on broken stone and gravel base, particularly when the movements are small.

The formation of transverse cracks in concrete bases can readily be ascribed to direct tension due to frictional resistance at a time when the concrete is contracting, whether this is caused by decrease in temperature, or by drying out of the moisture. The test results show that the coefficient of friction can readily vary from almost 0 to something over 2 or more, depending upon the movement of the concrete and the character of the sub-base. The distance between transverse cracks is dependent upon the coefficient of friction, and the total force of friction must extend over this distance.

Calling the coefficient of friction f , the distance between cracks D , the weight of the pavement per square foot w , we may write the equation:

$$f \times w \times D = \text{tensile strength of concrete per foot of width.}$$

Firm concrete. K. J. T. EKBELAW (*New York: The Macmillan Co., 1917, pp. 14-16, pls. 16, figs. 71*).—This is a nontechnical treatise on the subject, consisting of the following chapters: Cement; concrete; foundations and walls; pavements, floors, sidewalks, steps; concrete building blocks; concrete fence posts; tanks, troughs, and cisterns; drain tile, culverts, and bridges; concrete slabs; concrete surfaces and stucco; concrete in residences; and approximate strength tests, with an appendix giving standard specifications and tests for portland cement.

Tests of fuel for agricultural steam engines (*Bul. Dir. Gén. Agr., Com. et Coll. Tunis, 20 (1916), No. 87, pp. 49-55; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 7, pp. 1912, 1013*).—Tests of seven kinds of wood and of lignite and coal briquettes in a 24-horsepower steam engine driving a hay baler working at a rate of 40 to 50 bales per hour are reported.

It was found that wood could be used for running the engine, two and a half to three times as much wood as coal being required. Slightly better results were obtained with dry wood than with green wood, and also with the larger sized branches than with the smaller ones. The resinous wood gave about medium results. Lignite gave about twice as good results as wood.

It is concluded that the use of wood or lignite in Tunis for this purpose will depend on the cost of obtaining them. The use of wood is considered an incentive to clear forest lands for agriculture, and the use of lignite should further its exploitation as a rich local natural asset.

The cost of using farm motors, I, II (*Country Life* [London], 41 (1917, Nos. 1060, pp. 8*, 10*, fig. 1; 1961, pp. 8*, 10*, figs. 3).—This article summarizes the experiences of a number of farmers and the estimates of a few manufacturers on the cost of operating different agricultural tractors on different soils, with special reference to English conditions.

Profitable tractor farming, E. J. STEINMAN (*Iowa Agr.*, 18 (1917), No. 3, pp. 215-217, figs. 3).—A tractor survey conducted in nine Iowa counties, namely, Marshall, Boone, Hamilton, Hardin, Story, Humboldt, Pocahontas, Calhoun, and Webster Counties, to which 171 tractor owners responded, is reported.

It was found that 91.2 per cent of the 171 tractors were considered paying, and 515 horses were displaced, or 0.8 horse per 100-acre farm area. The 8-12, 10-20, and 12-25, or small-size tractors, constituted 71.9 per cent of the total reported. Fifty-five and five-tenths per cent of the tractors were on farms of less than 281 acres, and 90 per cent of these were successful. It cost from 25 to 60 cts. per acre for fuel and oil, plowing at the rate of from 0.69 to 1.16 acres per hour. Thirty-nine per cent of the tractor owners were doing custom work and 89.8 per cent of these considered it profitable. Eight and one-tenth per cent of the farm help was displaced on 75 farms.

Large fireproof barn and silos built of concrete (*Concrete* [Detroit, Mich.], 10 (1917), No. 5, pp. 175-177, figs. 8).—This article describes and illustrates a large concrete barn with twin silos, built near Duluth, Minn. It is stated that the double concrete walls and concrete floors have produced a building which proves a satisfactory stable at a temperature of 40° below zero.

Small cold storages and dairy buildings, J. A. RUDDICK and J. BURGESS (*Canada Dept. Agr., Dairy and Cold Storage Branch Bul.* 49 (1917), pp. 21, figs. 5).—This bulletin describes and illustrates plans for farm dairies, together with ice houses and refrigerators.

Fruit and vegetable storage structures (*Concrete* [Detroit, Mich.], 11 (1917), No. 2, pp. 37, 38, figs. 6).—Simple concrete storage cellars for fruits and vegetables are described and illustrated.

RURAL ECONOMICS.

Human food from an acre of staple farm products, M. O. COOPER and W. J. SPILLMAN (*U. S. Dept. Agr., Farmers' Bul.* 877 (1917), pp. 11).—This publication is designed to give an acre for acre comparison of the protein and energy value of different crops and animal products. The production of live stock products per acre was arrived at by assuming the acre to be planted in suitable food for live stock, in proper proportion to give a balanced ration.

According to the computations, corn furnishes the most calories per acre, the number being estimated at over 3,000,000. The next highest crop for energy production is sweet potatoes, furnishing 2,800,000 calories. Other products in their order of importance from this standpoint are Irish potatoes, rye, wheat, rice, soy beans, peanuts, oats, beans, cowpeas, and buckwheat. The number of calories obtained from an acre in the production of milk was approximately 700,000. The product next in importance among animal products was pork, with approximately 675,000 calories.

The largest estimated yields of protein per acre are from soy beans, beans, and corn.

[-tails regarding the method of making the computation and the results obtained for the various items are included.

The food supply of the German Empire (*Rpt. Physiol. (War) Committee Reg. Soc. [London], 1 (1915), pp. 6, figs. 2; 2 (1916), pp. 9*).—These reports discuss the food supply of Germany available during the first two years of the war and point out the changes in its composition.

The two agricultures, G. SAUVAGE (*Paris: Author, 1916, pp. 11+244*).—In his book is given a general review of agriculture in Germany and France and discussion of different types of agricultural instruction found, the use of agricultural machinery and motors, methods used in destroying injurious insects, and establishing new agricultural industries and enterprises.

Report of the national Scottish conference on employment on the land, 1916 (*Rpt. Nat. Scot. Conf. Employment on Land, 1916, pp. 104, pls. 3*).—Among the subjects discussed in this conference were the employment of women and of discharged soldiers and sailors on the land, methods of development and extension of small holdings, cooperation in farming, conditions of successful and settlement, and afforestation after the war.

Report on the private insurance organizations in Switzerland for 1915 (*Rpt. Bur. Suisse Assur., Entrep. Priv. Nat. Assur., 30, (1915), pp. 201*).—In his report are discussed the private insurance organizations for accidents, fire, rail, live stock, loss in transit, damage from weather, and damage to glass. Statistical data are also given showing the extent of the organizations and the amount of business done.

Cooperation in Wisconsin, B. H. HIBBARD and A. HOBSON (*Wisconsin Sta. Bul. 282 (1917), pp. 44, figs. 13*).—Among the types of cooperative organizations described are those connected with creameries, produce and feed, cheese, live stock, merchandise, fruit, telephones, and laundries. The authors give information regarding the extent of the various organizations and their development and the reasons for their successes and failures, and point out that their business now amounts to over \$62,000,000 per annum. Of the 83 creameries in the State 45 per cent are cooperative; of the cheese factories, 37 per cent. Among the various types of associations looking toward improvement of the livestock industries are live-stock shipping associations, community breeders' associations, and cow-testing associations.

It is pointed out that the professional promotion of associations by outside parties is to be deplored and discouraged.

Public markets in the United States, C. L. KING ET AL. (*Philadelphia: Nat. Munic. League, 1917, pp. 32*).—This is the second report of the committee on public markets of the National Municipal League, and includes information concerning public markets investments, annual receipts and expenditures, rental of stalls, inducements to farmers, attendance, price to consumers, sanitary conditions, and consumers' views of the markets.

Third annual report of the department of foods and markets, 1916 (*Ann. Nat. Dept. Foods and Markets, N. Y., 3 (1916), pp. 26*).—This report continues the information previously noted (*E. S. R., 36, p. 392*), and adds data regarding the investigation of methods of marketing foods, vegetables, poultry, and fish, and methods used in securing an advance in prices paid to producers of milk.

Second annual report of the director of farm markets for the State of Idaho, W. G. SCHLORZ (*Ann. Rpt. Dir. Farm Markets, Idaho, 2 (1916), pp. 27*).—Among the activities of the director of markets in Idaho were the establishing of a market news service, holding of State-wide conventions of farmers, development of public markets and dairy and fruit industries, and assisting in land settlement. There was also established an employment bureau for farm help.

[Farm market laws] (*Boise, Idaho: State Dept. Farm Markets, 1917, pp. 16*).—In this document are contained the text of the laws governing the Department of Farm Markets as passed by the Idaho legislature in 1917.

Arkansas warehouse, marketing, and gin regulating law (*Little Rock, Ark.: State Bd. Supervisors of Warehouses, 1917, pp. 95*).—This report contains the text of the law enacted in 1917, together with standard forms to be used in connection with the law.

Canadian Produce Association (*Canad. Prod. Assoc. Conv., 5 (1917), pp. [36]*).—Among the topics discussed at this convention, held in Montreal, were the loss-off system of buying eggs and quality payment, action of the Government through legislation regarding buying and selling of bad eggs, a system of weighing and inspecting butter, exportation of eggs to Great Britain, proposed standards for live and dressed poultry, and the organization of produce exchanged in Winnipeg and Montreal.

[Grain trade in the United States] (*Conf. Represents, Grain Trade 1917, Aug. 15, pp. 57*).—This report gives the proceedings of the Conference of Representatives of the Grain Trade of the United States, held in Washington, D. C., August 15, 1917, in regard to the formation of the U. S. Grain Corporation, its functions, and its methods of procedure.

Problems, prices, and profits of the packing industry (*Chicago: The Cudahy Packing Co., 1917, pp. 30, pl. 1*).—This report contains a reply to the Federal Trade Commission as to the causes of the present high prices, whether methods of distribution of meat and meat products are the most efficient possible, whether present methods interfere with the natural economic laws, and what remedies may be applied to overcome any weakness in the present system. The report sets forth in a general way the situation regarding the great packing house industries, and the profits derived from the present methods of distribution.

Report on the production of creameries and cheese factories, 1915 and 1916, E. H. GODFREY (*Canad. Census and Statis. Off., Rpt. Prod. Cream. and Cheese Fact., 1915-16 [English Ed.], pp. 16*).—This report gives statistical data showing by Provinces the number of different kinds of butter and cheese factories, the number of patrons, quantity of milk used, butter and cheese made, prices received for all dairy products, and foreign trade of Canada in dairy products.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 3 (1917), No. 19, pp. 93-104, fig. 1*).—This report contains the usual estimates of crop conditions, estimated farm value of important farm products, average prices received by producers, and range of prices of agricultural products at important markets, and also contains a special crop summary for October, special reports regarding the condition of crops in California and Florida and of pecans, and data with reference to the acreage of peanuts and fall onions, the production of hops, Kafir and broom corn, soy beans, and cabbage, the estimated wheat surplus and deficiency, by States, frost damage to corn, the percentage of hay baled, the increase in acreage of peas and beans for feed and food, etc.

[Florida State census of 1915] (*Bien. Rpt. Dept. Agr. Fla., 14 (1915-16), pt. 2, pp. 237-357*).—In this census data were gathered regarding the white and negro population; acreage, yield, and value of principal farm crops; number of live stock and number of thoroughbred stock; and the quantity of agricultural products sold. The data are shown by counties.

[Agriculture of Minnesota] (*In Minnesota's Fifty-second Anniversary, St. Paul: State Bd. Immigr., [1917], 10. ed., pp. 2-51, 72-200, figs. 71*).—The State Board of Immigration points out in this publication the resources by counties.

showing the area, types of soil, acreage in various crops, educational and religious facilities, banking conditions, and value of farm lands.

Agricultural statistics of Ireland (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statist. 1915*, pp. 110).—This report is a continuation of previous reports (E. S. R., 36, pp. 393), adding data for the year 1915.

[Agriculture in Norway] (*Statist. Aarbok Konger. Norge*, 35 (1915), pp. 23-36).—These pages continue data previously noted (E. S. R., 33, p. 594) by adding statistics for the year 1915.

[Agricultural statistics of Russia for 1915] (*Sborn. Statist. Zkon. Sviat. S. S. Khos. Ross. i Inostran. Gosud. (Rec. Données Statist. et Econ. Indus. Agr. Russ. et Pays. Étrangers)*, 10 (1917), pp. XIV+673).—This report continues data previously noted (E. S. R., 36, p. 594), adding information for 1915.

[Annual statistics of Egypt] (*Ann. Statist. Egypte*, 8 (1916), pp. 104-153, pl. 1).—This report continues data previously noted (E. S. R., 35, p. 894), giving statistics for later years.

AGRICULTURAL EDUCATION.

Report of the education branch for the year 1915-16 (*Jour. Bd. Agr. [London]*, 24 (1917), No. 4, pp. 385-394).—This is the annual report of the Board of Agriculture and Fisheries dealing with the agricultural education work of the various institutions and local authorities in England and Wales for 1915-16, as well as with the payments of grants during the financial year ended March 31, 1916.

During the year it was decided as a measure of war economy to suspend the grants to the Harris Institute, Preston, and to the Royal Horticultural Society's School at Wisley. The Royal Agricultural College, Cirencester, and the Agricultural College, Uckfield, Sussex, were closed in the summer of 1915, owing mainly to the serious decrease in attendance. All of the institutions have suffered as a result of the war. Their attendance in 1914-15 was as follows: long courses, 758, short courses, 666, as compared with 1,194 and 490, respectively, in 1913-14, and 1,284 and 593 in 1912-13. The new buildings at the Armstrong College, Newcastle, have been wholly utilized as a hospital since the beginning of the war, and rooms in the School of Agriculture, Cambridge, and in Wye College, were occupied for a time for military purposes. The Royal Veterinary College, London, is the only institution whose activities have not seriously diminished.

Local authorities held 292 organized day courses in 1915-16, attended by 4,063 students, as compared with 341 courses with an attendance of 3,544 in the previous year. The greater part of these courses were attended by women and were held in connection with traveling dairy schools. In several counties courses in farriery were held for soldiers. One hundred and seventy-one evening courses were held, attended by 3,227 pupils, as compared with 297 courses attended by 4,975 pupils in 1914-15. Classes in manual processes (hedging, plowing, milking, etc.) were held in 12 counties, the total number of meetings being 644; in the previous year 2,071 meetings were held in 21 counties.

To encourage cheese making instead of butter making, with a view both of conserving the food supply and the economical utilization of surplus milk, the Board developed a scheme of establishing traveling cheese schools, under which it loaned sets of apparatus to local authorities who agreed to make new and additional provision for itinerant instruction in this subject. Nineteen authorities availed themselves of this offer, and 33 new schools were created in addition to 5 previously in existence.

The total amount distributed by the board for agricultural education for 1915-16 was \$479,420 (including \$322,776.90 from the Development Fund), as compared with \$469,612 in 1914-15 and \$139,433 in 1911-12. The grants for 1915-16 included \$78,243 for universities and colleges, \$32,479 for advisory work, \$106,706 for research institutions and centers, \$30,963 for special research investigations, \$8,729 for research scholarships, \$135,633 for farm schools, technical classes, local lectures, etc., \$66,007 for the establishment of farm schools, \$5,638 toward the expenses of advisory councils, and \$14,862 for forestry advice, research, and experiments.

Eighth annual report of the eleven district agricultural schools of Georgia. J. S. STEWART (*Bul. Ga. State Col. Agr., No. 158 (1917), pp. 28, fig. 1*).—This is a report on the annual meeting of the principals and on the work of the 11 district agricultural schools of Georgia for the year 1916-17, including extension work, teacher training courses and summer institutes, special features, an outline of the 4-year courses in agriculture and home economics, and statistical data with reference to enrollment, land and equipment, and disposition of funds.

The total enrollment of the 11 schools was 1,622, ranging from 72 to 216 students. The schools cultivated a total of 1,094 acres, varying from 80 to 159 acres a school. The total value of their live stock was \$27,022, and of tools \$17,185.

It was agreed by the principals that the status of the schools be defined as that of 4-year high schools so articulated to the Georgia State College of Agriculture as to provide admission thereto on the basis of 14 Carnegie units, and further that 36 hours of technical work per month be required of each student without remuneration. It was suggested that the laboratory work required by the various schools be unified, and that as a general rule not less than seven periods per week (three recitations and two double laboratory hours) should be given to each science.

Agricultural education and experimentation in the Republic of Argentina. T. AMADEO (*Min. Agr. [Argentina], Div. Enseñanza Agr. [Pub.], No. 61 (1916), pp. 268, figs. 70*).—This report deals with the history, development, and present status of agricultural instruction in Argentina, the agricultural education budget and inventory, a proposed central institute of agricultural investigation, the agricultural education law, and the duties of public authorities with reference to agricultural education. Appendixes contain statistics of the agricultural education and investigation institutions with reference to the value of land, buildings, and equipment, and discussions of the cost of agricultural education institutions, a central institute of agricultural investigation, agricultural instruction in the normal and primary schools, and agricultural instruction for women in universities and special schools for men.

Report on agricultural and forestry education in the Dutch East Indies. H. C. H. DE BIE, W. G. BOORSMA, A. DE KONING, and L. DE BLIECK (*Jaarb. Dept. Landb., Nijv. en Handel Nederland. Indië, 1915, pp. 93-124, 155-164, 292-313*).—This annual report on the activities of the Department of Agriculture, Industries, and Commerce of the Dutch East Indies, includes a report on the progress of agricultural research and instruction in 1915. The latter comprises instruction given in the Higher Agricultural School at Buitenzorg, a secondary school of cultivation at Soekaboemi, a veterinary school at Buitenzorg, 17 elementary agricultural schools for the natives, normal schools, special courses of lectures, demonstrations, etc., for adults, and an experiment in giving instruction in agriculture to the higher classes of village public schools.

The study of veterinary science. M. CUMMING, F. T. DAUBIGNY, J. H. REED, C. D. MCGILVRAY, W. J. RUTHERFORD, and H. A. CRAIG (*Agr. Gaz. Canada, 4 (1917), No. 10, pp. 874-881*).—A brief description is presented of the instruc-

tion in veterinary science given in Nova Scotia by the College of Agriculture; in Quebec by the School of Comparative Medicine and Veterinary Science, affiliated with Laval University; in Ontario by the Ontario Veterinary College, and the veterinary department of Ontario Agricultural College, in Manitoba by the Manitoba Agricultural College; in Saskatchewan by the College of Agriculture of the University of Saskatchewan; and in Alberta by the schools of agriculture at Olds, Claresholm, and Vermillion.

Productive farming, K. C. DAVIS (*Philadelphia and London: J. B. Lippincott Co., 1917, 3. (ed. rev. and enl., pp. VIII+427, pl. 1, figs. 244).*—This is a third revised and enlarged edition of this text, previously noted (*E. S. R.*, 28, p. 333). The principal additions include chapters on tobacco for market and road construction and mechanics, and suggestions to teachers for additional exercises and projects. There are also minor additions throughout the text and the data in the appendixes are brought up to date.

Summer courses in agriculture for teachers, D. A. DEWOLF, R. P. STEVES, F. C. HARRISON, J. B. DANDENO, R. FLETCHER, A. W. COCKS, J. C. MILLER, and J. W. GIBSON (*Agr. Gaz. Canada, 4 (1917), No. 10, pp. 887-900, figs. 7).*—Reports are given with reference to attendance, organization, and subjects and length of courses in agriculture for teachers in 1917 summer schools in Nova Scotia, New Brunswick, Macdonald College, Ontario Agricultural College, Manitoba, Saskatchewan, Alberta, and British Columbia.

School and home gardening, J. L. RANDALL (*Rpt. Comr. Ed. [U. S.], 1915-16, 1, pp. 259-270).*—In this review the author discusses the need for gardening, the early history and present status of children's gardens, garden promotion by agencies other than schools, gardening in several recent city school surveys, the plan of gardening suggested by the school and home gardening division of the U. S. Bureau of Education, and children's gardens in Porto Rico and the Philippine Islands. A brief statement with reference to the care of school gardens during the summer vacation in Canada, by C. H. Lane, is included.

Instruction in gardening in cooperation with the International Children's School Farm League (*Jour. N. Y. Bot. Gard., 18 (1917), No. 207, pp. 53-61, pl. 1).*—An account is given of a plan of cooperation which became effective April 1, 1917, between the International Children's School Farm League and the New York Botanical Garden for the establishment at the garden of a training school for teachers of children's gardens and others interested in gardening. The members of the garden, in consideration of a guaranty of \$4,400 a year for a term of not less than two years, agree to set apart and prepare a tract of land to furnish lecture-room accommodations, library and herbarium facilities, etc., for the purpose.

The gardening courses to be offered are outlined.

Gardening for little girls, OLIVE H. FOSTER (*New York: Duffield & Co., 1917, 17 (16)+144, pls. 8, figs. 4).*—Directions are given for planning and planting flower gardens, together with information with reference to colors, season of bloom, etc., of the more common annuals and perennials.

Boys' and girls' club contests, J. E. McLARY ET AL. (*Agr. Gaz. Canada, 4 (1917), No. 6, pp. 476-483).*—Brief accounts are given of the present status of boys' and girls' club contests in the Provinces of Prince Edward Island, Nova Scotia, Quebec, Manitoba, Saskatchewan, Alberta, and British Columbia.

MISCELLANEOUS.

Fortieth Annual Report of Connecticut State Station, 1916 (*Connecticut Sta. Rpt. 1916, pt. 6, pp. XXII).*—This contains the organization list, a report of the board of control, and a financial statement for the fiscal year ended September 30, 1916.

Twenty-ninth Annual Report of Massachusetts Station, 1916 (*Massachusetts Sta. Rpt. 1916, pts. 1-2, pp. X+92a+319, figs. 150*).—This contains the organization list, reports of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1916, and reprints of Bulletins 168-172, previously noted. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirtieth Annual Report of Nebraska Station, 1916 (*Nebraska Sta. Rpt. 1916, pp. I-III*).—This contains the organization list, a report as to the work of the year, a report of the extension service of the college of agriculture, and a financial statement for the period ended June 30, 1916. The experimental work reported is for the most part abstracted elsewhere in this issue.

Miscellaneous experiments (*Pennsylvania Sta. Bul. 147 (1917), pp. 40, fig. 21*).—This bulletin contains a number of short articles, the experimental features of which are for the most part abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., II (1917), No. 10, pp. 315-349, figs. 11*).—This contains several articles abstracted elsewhere in this issue; Acid Soils and Soil Acidity, by C. J. Schollenberger; and notes.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 5 (1917), Nos. 7, pp. 93-108, figs. 2; 8, pp. 109-124, figs. 7*).—These numbers contain brief articles on the following subjects:

No. 7.—The Farmer's Opportunity, by H. L. Blanchard; Good Fall Farming Practice in Western Washington, by E. B. Stookey; Pure-bred Sires Pay, by N. C. Jamison; Fruit, A Food Essential, by R. J. Barnett; The Home Fruit Garden, by J. L. Stahl; Standardizing Eggs, by Mr. and Mrs. G. R. Shoup, including a description of a homemade egg-grading device; How About Your Drinking Water? by C. A. Magoon; and Home-grown Kale Seed, by E. B. Stookey.

No. 8.—Safe and Sane Methods of Increasing Food Production, by G. Serenace; Farmyard Manure—Our Best Fertilizer, by E. B. Stookey; Handling Poultry Manure, by Mr. and Mrs. G. R. Shoup, including a description of a homemade poultry manure cart; The Farm Flock, by C. E. Howell; Currants and Gooseberries in Western Washington, by J. L. Stahl; Why Do Trees Fail to Fruit? by J. L. Stahl; Storage Rots of Potatoes, by A. Frank; and Four Common Plant Diseases, by A. Frank.

NOTES.

Arizona University and Station.—Dr. R. H. Forbes, dean of the college of agriculture and director of the station, has been given a year's leave of absence to assist the Société Sultanienne d'Agriculture, of Cairo, Egypt, in agricultural service in the valley of the Nile. Charles R. Adamson has resigned as county agent to become a county agent.

Kansas College and Station.—Dean W. M. Jardine has been appointed president and Dr. J. T. Willard, vice president. Harry L. Keut, associate professor of education and principal of the school of agriculture, has been appointed state director of education under the Federal Vocational Education Aid Act. R. W. Kiser, instructor in animal husbandry and superintendent of land and live stock, has become extension animal husbandman and has been succeeded by J. W. Crumbaker, foreman of the agronomy farm, and he in turn by Geo. H. Finney. N. E. Olson has resigned as assistant in dairying and has been succeeded by W. R. Davis. H. A. Pratt has been appointed assistant in horticulture and foreman of the greenhouse, vice W. F. Pickett resigned.

Maine Station.—Dr. Raymond Pearl, biologist and for some time in charge of statistical work for the U. S. Food Administration, has been appointed head of the department of biometry and vital statistics in the school of hygiene and public health of John Hopkins University.

Nevada University and Station.—Dr. Winfred B. Mack, head of the department of veterinary science and bacteriology in the university and station since 1927 and head of the State Veterinary Control Service, died January 18 at the age of 46 years. Dr. Mack was a 1904 graduate of the New York State Veterinary College with two years post graduate training, and in 1905-6 was assistant in comparative pathology and bacteriology at Cornell University. His work in Nevada had dealt mainly with diseases of live stock, notably infectious bronchitis of horses, contagious epithelioma of chickens, and various disorders of sheep and cattle. Of late he had been giving particular attention to quarantine and inspection work, including the supervision of the campaign against ticks.

New Mexico Station.—C. A. Thompson, assistant in soils in the Washington Station, has been appointed assistant agronomist, vice A. Z. Smith, who has taken up county agent work.

New York State Station.—F. H. Hall, vice director and editor, has been granted leave of absence to take charge of publicity work of the U. S. Food Administration dealing with perishable foods.

Wisconsin University and Station.—Dean H. L. Russell has been granted leave of absence to succeed George E. Haskell in charge of the work with butter and cheese of the United States Food Administration.

Progress in Agricultural and Home Economics Instruction in Canada.—The chief of the Military Convalescent Home of Sans-Bruit, Quebec, has made arrangements for teaching agriculture to convalescent soldiers, the courses being in charge of a district agricultural representative. Instruction has been given in practical work in drainage surveys and rotations on the hospital farm, commercial poultry keeping, market gardening, and beekeeping. Some of the

convalescents have also helped in field husbandry, soil preparation, harvesting, etc.

What are known as the royal agricultural schools, incorporated by the legislature of Quebec, are designed to give instruction to the sons of soldiers. These schools and farms are situated in the township of Howard, Argenteau County, and are open to the sons of all soldiers who have taken part in the war. The property of the schools consists of 3,468 acres, with a large residential building to accommodate 25 boys, a residence for teachers, and a number of cottages for workmen. The parents of the boys will be under no expense for their sons while they are at the schools, and when of sufficient age the boys will be assisted in making a start for themselves.

A two-year agricultural course was opened at the Victoria (B. C.) high school last fall with 30 boys and girls in attendance. It has been substituted for one or both of the two foreign languages previously required, except that students wishing to qualify for first-class teachers' certificates or for entrance to the university must include with agriculture the study of one foreign language. All of the usual branches of agriculture are covered, and with some slight variation in the second year, when home economics for girls and certain special topics in agriculture for boys are emphasized, are the same for boys and girls.

Farm Schools in the Philippines.—Beginning with the present school year 1917-18, all schools where a course in farming is given are to be in session throughout the year. This is not entirely a new venture, as for several years all settlement farm schools and most agricultural schools have been in continuous session, and notwithstanding the younger pupils enrolled in them the schools have maintained the best farms.

The calendar year has been divided into 42 weeks of classroom work, 4 weeks of special field practice, 4 weeks of vacation, and 1 week each for examinations and an annual cleaning up. Each pupil enrolled will be given a vacation of 4 weeks at the time in the year that the farm activities can best spare his services. All teachers assigned to farm schools are required to render service throughout the school year, except that short vacations may be given when their services can be spared.

It is believed that students should be detailed to definite projects and thereby become factors in a productive enterprise. Each pupil is expected to do field work for not less than 4 consecutive periods (160 minutes) each day for 5 days a week, and daily field work up to 3.5 hours may be required at the option of the principal. Each pupil is required to perform at least 3 hours of field work on every other Saturday forenoon.

The same school year and calendar hold for the domestic science classes in farm schools. For the required four weeks of all-day work the principals must select one or more of the following activities for the girls: Canning and cooking, the preparation and serving of midday meals to the boys on all-day work detail, commercial lace or embroidery making, or sewing on their own clothes or clothing for members of their families. The services of the girls are employed during the harvest periods in assisting with certain kinds of field work.

Agricultural Instruction for Orphans of Farmers Killed in the War in Italy.—Francesco Borgogna has instituted in the Home for the Poor in Verona 12 places for orphans of farmers who have fallen in battle. This provision will give them an opportunity to complete the elementary course and the secondary courses in the professional school of agriculture in the Borgogna Royal Professional School, leading to the diploma of special field agent in rice culture.

